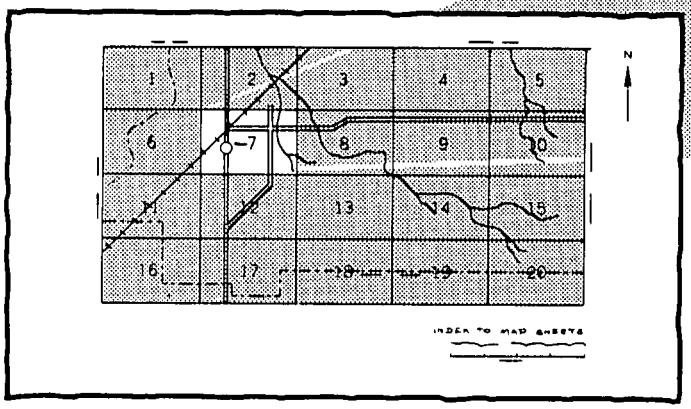
soil survey of

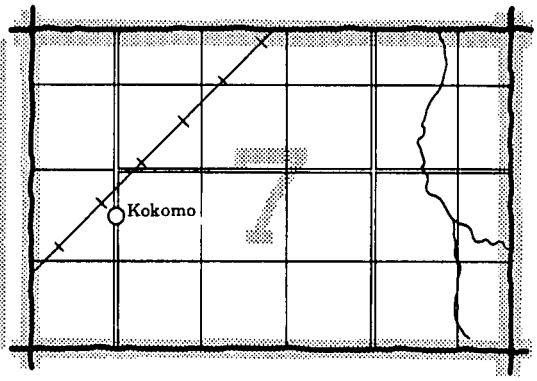
Weld County, Colorado
Northern Part

United States Department of Agriculture
Soil Conservation Service and Forest Service
in cooperation with
Colorado Agricultural Experiment Station

HOW TO USE

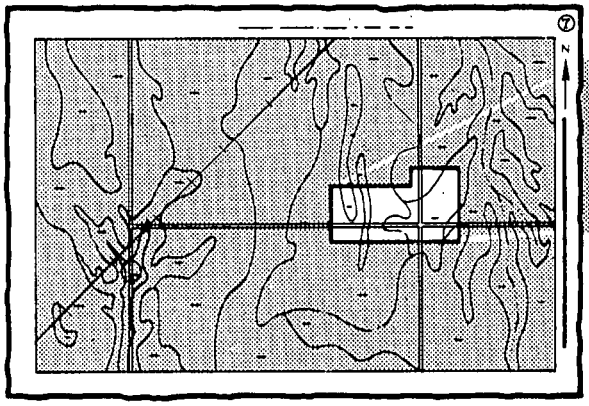
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

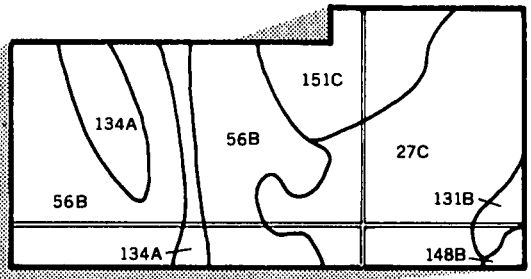




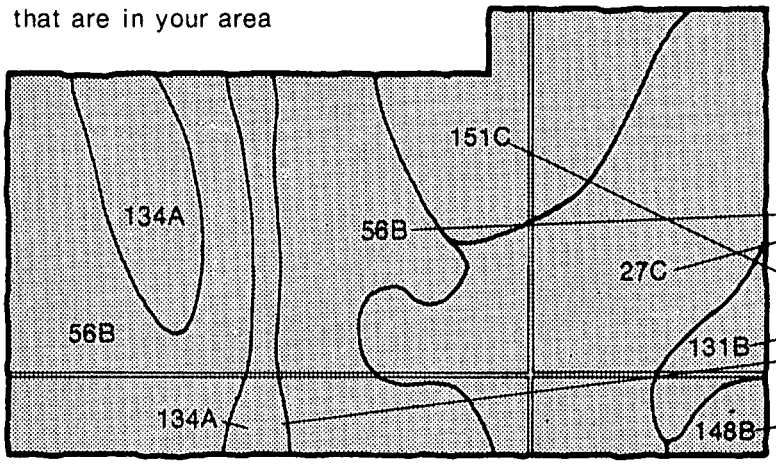
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.





4. List the map unit symbols that are in your area

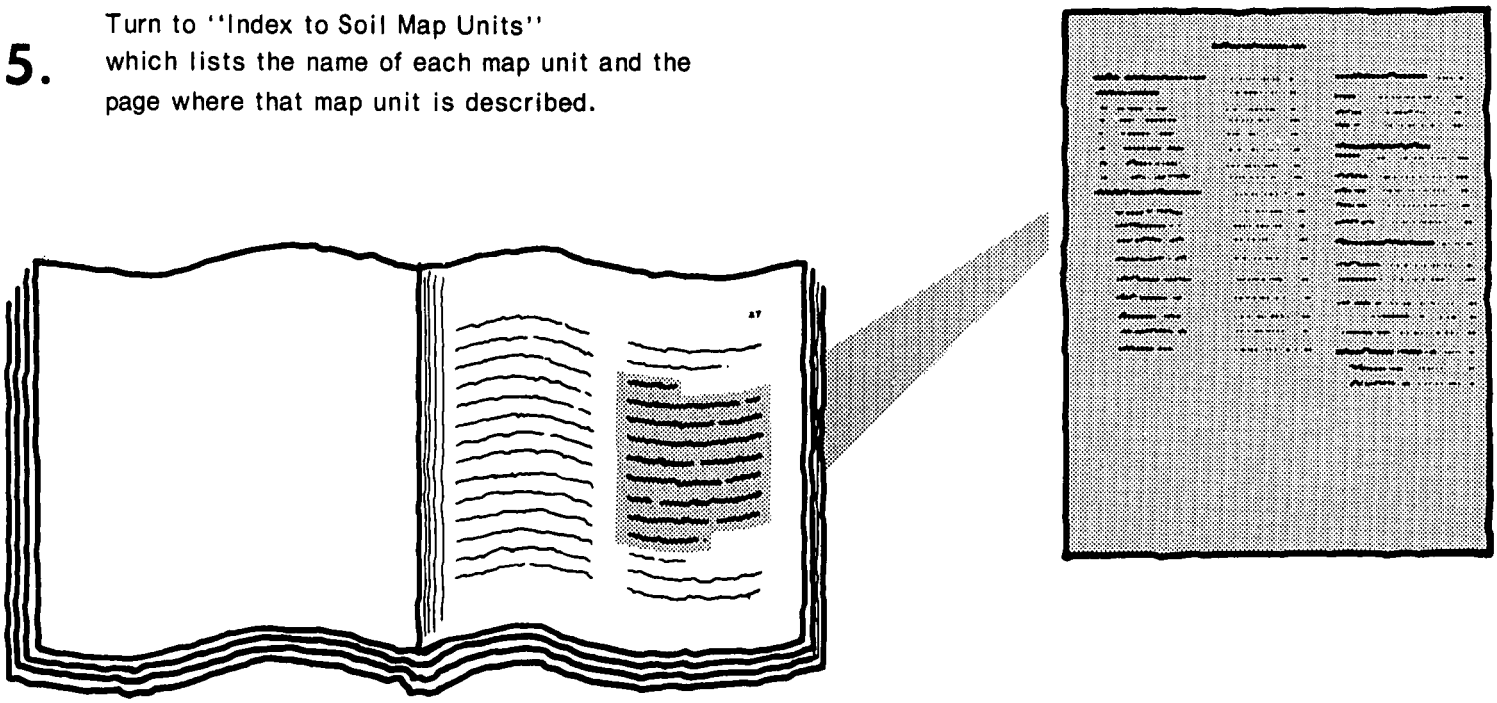


Symbols

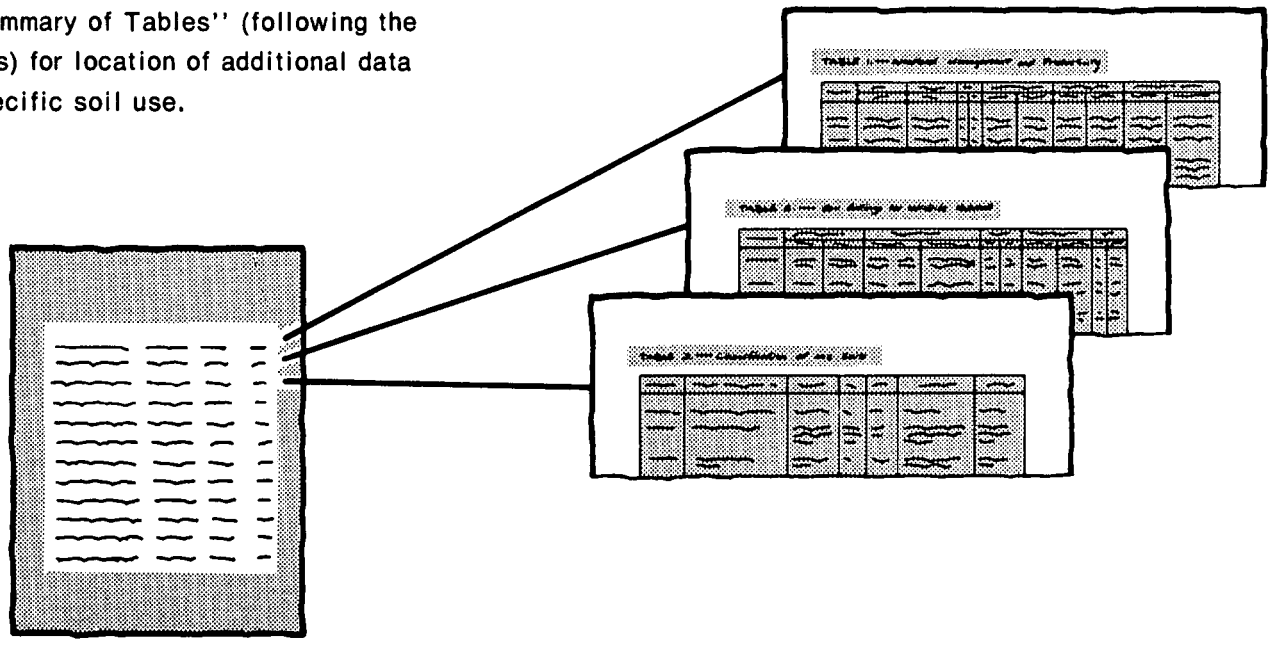
27C
56B
131B
134A
148B
151C

THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map unit is described.



6. See "Summary of Tables" (following the Contents) for location of additional data on a specific soil use.



7. Consult "Contents" for parts of the publication that will meet your specific needs. This survey contains useful information for farmers or ranchers, foresters or agronomists; for planners, community decision makers, engineers, developers, builders, or homebuyers; for conservationists, recreationists, teachers, or students; for specialists in wildlife management, waste disposal, or pollution control.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was performed in the period 1976-79. Soil names and descriptions were approved in 1979. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1979. This survey was made cooperatively by the Soil Conservation Service, the Forest Service, the Colorado Agricultural Experiment Station, and Weld County. It is part of the technical assistance furnished to the West Greeley, Centennial, and Morgan Soil Conservation Districts.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

contents

soil series

Issued August 1982

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summary of tables

foreword

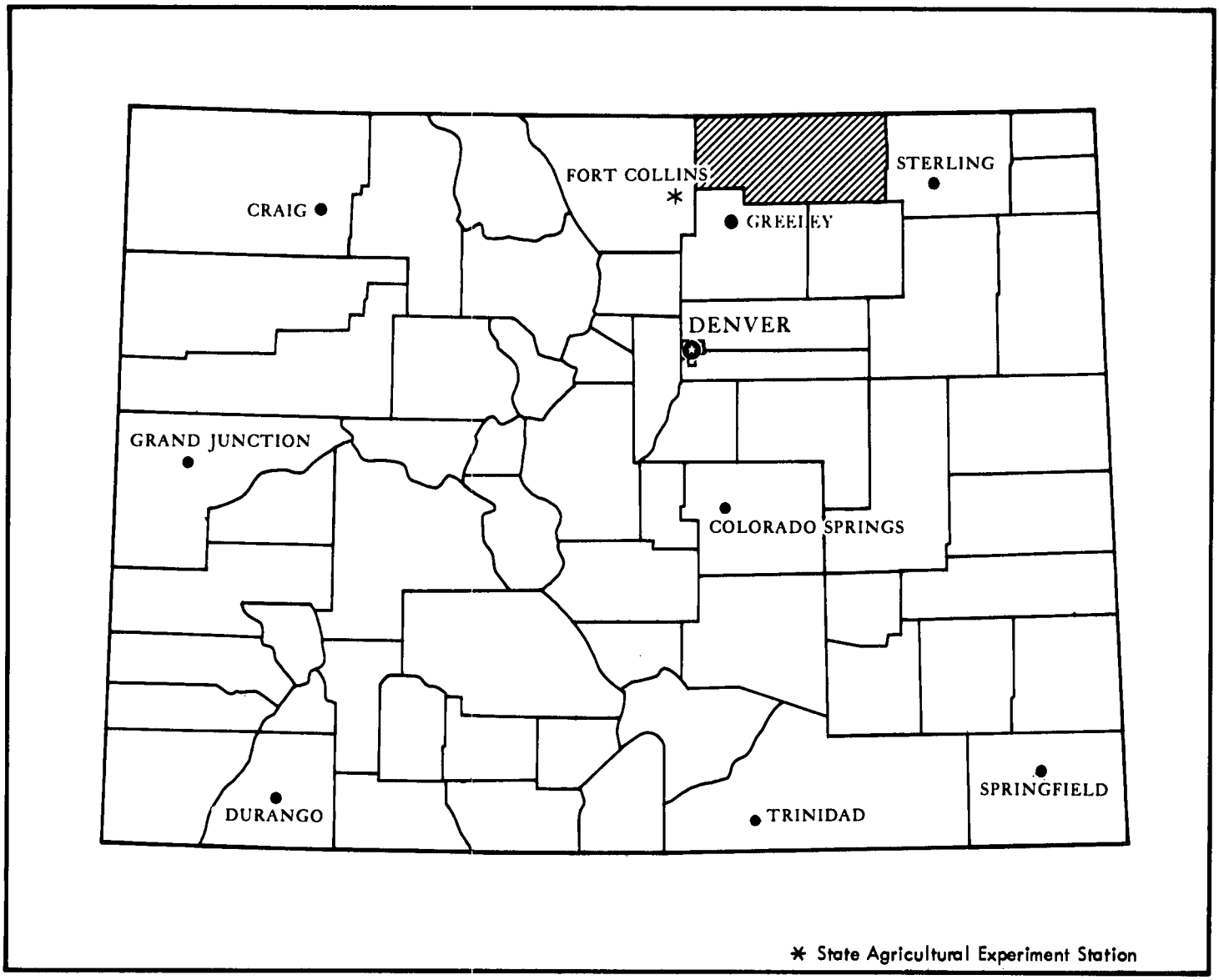
This soil survey contains information that can be used in land-planning programs in Weld County, Northern Part. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, ranchers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Sheldon G. Boone
State Conservationist
Soil Conservation Service



Location of Weld County, Colorado, Northern Part.

soil survey of
Weld County, Colorado
Northern Part

By James A. Crabb, Soil Conservation Service

Fieldwork by James A. Crabb, Peter L. Smith, and Dwight E. Curtiss, Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service and Forest Service, in cooperation with Colorado Agricultural Experiment Station

WELD COUNTY, NORTHERN PART, is in the northeastern part of Colorado. It is north of Denver and east of the Rocky Mountains. The total area is 1,429,520 acres, or about 2,233 square miles. Greeley, the county seat, is in the southern part of the county.

Most of the acreage in the survey area is used as rangeland and nonirrigated cropland. A small acreage is used as irrigated cropland.

Descriptions, names, and delineations of soils in this soil survey do not fully agree with those on soil maps for adjacent counties. Differences are the result of better knowledge of soils, modifications in series concepts, intensity of mapping, or the extent of soils within the survey.

general nature of the survey area

This section discusses the physiography, drainage, and relief and the climate in the survey area. It also discusses the Pawnee National Grassland.

physiography, drainage, and relief

The survey area is in the northern part of the Colorado Piedmont. It is in three distinct physiographic areas. A knowledge of the location and nature of these areas helps in understanding the soils and agriculture in the survey area.

The largest part of the survey area is on a gently undulating to rolling plain. This part has great agricultural value. The soils on the plain formed mainly in alluvium. Also on the plain are some areas of reworked old alluvium, wind-modified alluvium, and exposed weathered bedrock, which borders the escarpments to the north.

The most easily observable physiographic area is the escarpments that extend across the survey area from west to east. "Chalk Bluffs" and "Pawnee Buttes" are in this area. The escarpments are rolling to steep, and they consist of rock outcroppings of siltstone that commonly have a cap of sandstone. Deposits of material derived from siltstone, sandstone, and some shale are directly below the escarpments. The escarpments are used mainly for cattle grazing and wildlife habitat.

To the north and at a higher elevation than the escarpments is a gently undulating to rolling high plain. The soils on this plain formed in alluvium and residuum derived from sandstone. The high plain has agricultural value.

The survey area is drained by numerous intermittent creeks. Some of the major creeks in the western part of the survey area are Spring, Lone Tree, Owl, and Crow Creeks. They flow in a southerly direction through the survey area and join the South Platte River outside the area.

The major drainageways in the eastern part of the area are Sidney Draw and Cedar and Pawnee Creeks. Sidney Draw flows in a northeasterly direction through the survey area and joins Lodgepole Creek in Nebraska. Cedar and Pawnee Creeks drain to the east and join the South Platte River in Logan County.

Elevation in the survey area ranges from approximately 6,350 feet at the extreme northwestern corner to 4,300 feet where Pawnee Creek flows from the area to the east.

climate

Prepared by the National Climatic Center, Asheville, North Carolina.

The survey area generally is warm in summer and has freqent hot days. In winter, periods of very cold weather occur as a result of Arctic air moving in from the north or northeast; however, milder periods occur when westerly winds are warmed as they move downslope. Most precipitation falls as rain during the warmer part of the year and normally is heaviest late in spring and early in summer. Winter snowstorms are frequent, but snow cover commonly disappears during milder periods.

In winter, the average temperature is 29 degrees F and the average daily minimum temperature is 14 degrees. The lowest temperature on record, which occurred at Greeley on February 1, 1951, is -39 degrees. In summer, the average temperature is 70 degrees and the average daily maximum temperature is 87 degrees. The highest recorded temperature, which occurred at Ft. Lupton on June 23, 1954, is 108 degrees.

The total annual precipitation is 12 inches. Of this, 9 inches, or 75 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 6.5 inches. The heaviest 1-day rainfall during the period of record was 3.2 inches at Greeley on June 8, 1974. Thunderstorms occur on about 41 days each year, and most occur in summer.

The average seasonal snowfall is 40 inches. The greatest snow depth at any one time during the period of record was 30 inches. On an average of 18 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 40 percent. Humidity is higher at night, and the average at dawn is about 69 percent. The sun shines 71 percent of the time possible in summer and 70 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 10.4 miles per hour, in April.

In some years during winter, a blizzard with high winds and drifting snow occurs in the survey area and snow remains on the ground for many weeks. In some years during summer, hailstorms cause severe damage to crops in the area.

Pawnee National Grassland

By Steward J. Adams, district ranger, Forest Service.

The Pawnee National Grassland (see map at the back of this publication) is one of 19 national grasslands in the western United States. Most of the Pawnee National Grassland is flat to rolling prairie grassland intermingled with privately owned farmland and grassland.

The national grasslands were started as part of an economic program. The land originally was settled by stockmen whose ranches covered vast areas of the plains. During the late 1800's, overgrazing and competition for forage started to be a problem. The homestead acts of the late 1800's and early 1900's brought in more and more farmers, and by 1913 about 35 percent of the area had been converted to cropland.

The drought and depression of the 1930's caused a decline in the number of small cultivated farms. Farmers could no longer make a living from small holdings managed for intensive cash crops. Many farmers left the area. The Bankhead-Jones Farm Tenant Act, passed in 1937, was a repurchase law designed to aid the resettlement of farmers, to convert submarginal cropland back to grassland, to help stabilize the economy, and to assist those who chose to stay.

The Soil Conservation Service administered the purchase units as land utilization projects from 1938 to 1954. The land was then transferred to the Forest Service. Studies of the land were made, and in 1960 the areas of rangeland suitable for permanent retention were designated as national grasslands. The grasslands became a part of the national forest system. In 1961 the grassland in the survey area was designated Pawnee National Grassland.

Presently, about 10,000 cattle graze the public land of the Pawnee National Grassland, which facilitates the total management and enhances the economy of the area. The objective of management of national grasslands is to develop and execute conservation and utilization programs for all renewable resources in national grassland areas; this, to the extent feasible, promotes the integration of the federally administered land with the associated private and other public lands into natural management units, which favors the development of sound land conservation and utilization practices. Cattle use the forage about 5 months out of the year.

The federal land is open to hunting that is subject to state laws and regulations. Wildlife in this grassland area includes antelope, a few deer, some coyotes, and rabbits. A few prairie dog towns are scattered throughout the area.

One of the main recreational uses of the area is bird watching. The grassland supports large numbers of birds of many species, especially during migrations. The area is known internationally as an excellent study area for birds of prey, and it has good breeding populations of unique high plains species such as mountain plover, burrowing owl, McCowan's longspur, and chestnut-collared longspur. Hikers also use areas of the grassland, although there are no special hiking trails.

Crow Valley Park is one-fourth mile north of the town of Briggsdale. The park is located among shade trees along Crow Creek. Picnic and camping areas are in the park. The campground is closed in winter.

Additional information on the Pawnee National Grassland can be obtained from the local office of the Forest Service.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map units" and "Detailed soil map units."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, rangeland and woodland managers, engineers, planners, developers and builders, home buyers, and others.

general soil map units

The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, a map unit consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one unit can occur in other units but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The 13 map units in this survey have been grouped into 6 general kinds of landscape for broad interpretive purposes. Each of the broad groups and the map units in each group are described in the following pages.

loamy soils on flood plains and adjacent stream terraces and in swales

This group consists of one map unit. It makes up about 4 percent of the survey area. The soils in this group are nearly level to gently sloping. The vegetation in areas not cultivated is mainly grasses, forbs, and shrubs and a limited number of hardwoods. The average annual precipitation is 11 to 13 inches.

The soils in this group are deep and well drained. They formed in calcareous loamy alluvium.

Most areas of this group are used as rangeland. A few areas are used as nonirrigated cropland.

1. Haverson-Avar

Deep, well drained, nearly level to gently sloping soils; on flood plains and adjacent stream terraces and in swales

This map unit is throughout the survey area. Generally, it is oriented in the northwest to southeast direction. Slope is 0 to 3 percent. The vegetation on this unit is mainly grasses, forbs, and shrubs, but there are some hardwoods along the larger intermittent streams. Elevation is 4,700 to 5,350 feet.

This unit makes up about 4 percent of the survey area. It is about 50 percent Haverson soils and 30 percent Avar soils. The remaining 20 percent is components of minor extent.

Haverson soils are on flood plains and adjacent stream terraces. These soils formed in stratified, calcareous loamy alluvium. They are medium textured throughout.

Avar soils are on flood plains and adjacent stream terraces and in closed swales. These soils formed in calcareous loamy alluvium. The surface layer is moderately fine textured. The subsoil is fine textured. These soils are very strongly alkaline. Numerous slick spots are in some areas.

Of minor extent in this unit are the well drained Ascalon, Bankard, Manzanola, Olney, Paoli, and Vona soils and the poorly drained Haplaquolls and Fluvaquents.

Most areas of this unit are used as rangeland. A few areas are used as nonirrigated cropland. The main limitations for most uses are the hazard of soil blowing, the salinity of the Avar soils, and the hazard of flooding on the Haverson soils. Management practices that reduce soil blowing and conserve moisture should be used.

loamy soils on plains, adjacent stream terraces, and upland ridges

This group consists of four map units. It makes up about 54 percent of the survey area. The soils in this group are nearly level to hilly. The vegetation in areas not cultivated is mainly grasses, forbs, and shrubs. The average annual precipitation is 11 to 13 inches.

The soils in this group are shallow to deep and are well drained. They formed in calcareous gravelly alluvium, in calcareous loamy alluvium and colluvium, and in calcareous clayey or loamy residuum derived from shale and sandstone.

This group is used as nonirrigated cropland and rangeland.

2. Olney-Ascalon-Platner

Deep, well drained, nearly level to rolling soils; on plains and adjacent stream terraces

This map unit is throughout the survey area; however, it is mainly south of the sandstone escarpments in the

northern part of the area. Slopes are smooth to highly dissected and are 0 to 15 percent. The vegetation in areas not cultivated is mainly grasses, forbs, and shrubs. Elevation is 4,400 to 5,700 feet.

This unit makes up about 38 percent of the survey area. It is about 27 percent Olney soils, 16 percent Ascalon soils, and 13 percent Platner soils. The remaining 44 percent is components of minor extent.

Olney soils are gently undulating and are on plains. These soils formed in calcareous loamy alluvium. The surface layer is moderately coarse textured, and the subsoil is moderately fine textured.

Ascalon soils are nearly level to rolling and are on plains and adjacent stream terraces. These soils formed in calcareous loamy alluvium. The surface layer is moderately coarse textured to medium textured, and the subsoil is moderately fine textured.

Platner soils are nearly level to gently sloping and are on plains and adjacent stream terraces. These soils formed in calcareous loamy alluvium. The surface layer is moderately coarse textured, and the subsoil is fine textured.

Of minor extent in this unit are the well drained Manzanola, Nunn, Renohill, Stoneham, Vona, and Wages soils and excessively drained Cascajo and Peetz soils.

This unit is used as nonirrigated cropland and rangeland. Wheat and sorghum are the main cultivated crops. The main limitations for most uses are the hazards of soil blowing and water erosion. Management practices that conserve moisture, control runoff, and reduce soil blowing should be used.

3. Altvan-Dacono

Deep, well drained, nearly level to gently undulating soils; on plains and adjacent stream terraces

This map unit is in the western part of the survey area, in the vicinity of Spring and Lone Tree Creeks. Generally, it is oriented in a northwesterly to southeasterly direction. Slopes are smooth to moderately dissected and are 0 to 6 percent. The vegetation in areas not cultivated is mainly grasses, forbs, and shrubs. Elevation is 5,050 to 5,800 feet.

This unit makes up about 2 percent of the survey area. It is about 40 percent Altvan soils and 22 percent Dacono soils. The remaining 38 percent is components of minor extent.

Altvan soils are on smooth to moderately dissected plains. These soils formed in calcareous gravelly alluvium. The surface layer is moderately coarse textured, and the subsoil is moderately fine textured. Sand and gravel are at a depth of 20 to 40 inches.

Dacono soils are on smooth to slightly dissected plains and adjacent stream terraces. These soils formed in calcareous loamy alluvium. The surface layer is moderately fine textured, and the subsoil is fine textured. Sand and gravel are at a depth of 20 to 40 inches.

Of minor extent in this unit are the well drained Ascalon, Haverson, Nunn, Olney, and Vona soils.

This unit is used as nonirrigated cropland and rangeland. Wheat and sorghum are the main cultivated crops. The main limitations for most uses are the hazards of soil blowing and water erosion. Management practices that conserve moisture, control runoff, and reduce soil blowing should be used.

4. Terry-Otero-Tassel

Shallow to deep, well drained, nearly level to hilly soils; on plains

This map unit is along the western edge of the survey area, bordering Larimer County. Slopes are smooth to highly dissected and are 0 to 25 percent. The vegetation in areas not cultivated is mainly grasses, forbs, and shrubs. Elevation is 5,100 to 5,550 feet.

This unit makes up about 1 percent of the survey area. It is about 60 percent Terry soils, 16 percent Otero soils, and 9 percent Tassel soils. The remaining 15 percent is components of minor extent.

Terry soils are nearly level and gently undulating. They are moderately deep and are on smooth to highly dissected plains. These soils formed in calcareous residuum derived from sandstone. The surface layer and subsoil are moderately coarse textured. Sandstone is at a depth of 20 to 40 inches.

Otero soils are nearly level to hilly. They are deep and are on smooth to highly dissected plains. These soils formed in calcareous loamy alluvium. They are moderately coarse textured throughout.

Tassel soils are shallow and are on moderately dissected to highly dissected plains. These soils formed in calcareous loamy residuum derived from sandstone. They are moderately coarse textured and are underlain by sandstone at a depth of 10 to 20 inches.

Of minor extent in this unit are the well drained Nunn and Olney soils and excessively drained Cascajo soils.

This unit is used as nonirrigated cropland and rangeland. Wheat, barley, and sorghum are the main cultivated crops. The main limitations for most uses are the hazards of soil blowing and water erosion. Management practices that conserve moisture, control runoff, and reduce soil blowing should be used.

5. Renohill-Terry-Shingle

Shallow to moderately deep, well drained, nearly level to hilly soils; on plains and upland ridges

This map unit is throughout the survey area, but most of it is west and north of Briggsdale. Slopes are slightly dissected to highly dissected and are 0 to 30 percent. The vegetation in areas not cultivated is mainly grasses, forbs, and shrubs. Elevation is 4,450 to 5,800 feet.

This unit makes up about 13 percent of the survey area. It is about 38 percent Renohill soils, 10 percent Terry soils, and 8 percent Shingle soils. The remaining 44 percent is components of minor extent.

Renohill soils are nearly level to sloping. They are moderately deep and are on slightly dissected to highly dissected plains and upland ridges. These soils formed in calcareous loamy or clayey residuum derived from shale. The surface layer is moderately coarse textured, and the subsoil is fine textured. Shale is at a depth of 20 to 40 inches.

Terry soils are nearly level to sloping. They are moderately deep and are on smooth to highly dissected plains. These soils formed in calcareous residuum derived from sandstone. The surface layer and subsoil are moderately coarse textured. Sandstone is at a depth of 20 to 40 inches.

Shingle soils are nearly level to hilly. They are shallow and are on slightly dissected to highly dissected plains and upland ridges. These soils formed in calcareous loamy or clayey residuum derived from shale. The surface layer is moderately fine textured, and the underlying material is fine textured. Shale is at a depth of 10 to 20 inches.

Of minor extent in this unit are well drained Ascalon, Nunn, Olney, Otero, Platner, Stoneham, and Tassel soils and excessively drained Cascajo soils.

Most areas of this unit are used as rangeland. A few areas are used as nonirrigated cropland. Wheat, barley, and sorghum are the main cultivated crops. The main limitations for most uses are the hazards of soil blowing and water erosion. Management practices that conserve moisture, control runoff, and reduce soil blowing should be used.

loamy soils on breaks, dissected plains, and fans

This group consists of one map unit. It makes up about 4 percent of the survey area. The soils in this group are gently undulating to hilly. The vegetation is mainly grasses, forbs, and shrubs. The average annual precipitation is 11 to 13 inches.

The soils in this group are shallow to deep and are well drained. They formed in calcareous loamy alluvium and colluvium and in calcareous loamy or clayey residuum derived from shale.

This group is used as rangeland.

6. Kim-Otero-Shingle

Shallow to deep, well drained, gently undulating to hilly soils; on breaks, dissected plains, and fans

This map unit is north of Raymer and Stoneham, along the breaks of Pawnee Creek and its major tributaries. Slopes are slightly dissected to highly dissected and are 6 to 30 percent. The vegetation is mainly grasses, forbs, and shrubs. Elevation is 4,300 to 4,750 feet.

This unit makes up about 4 percent of the survey area. It is about 38 percent Kim soils, 20 percent Otero soils, and 16 percent Shingle soils. The remaining 26 percent is components of minor extent.

Kim soils are sloping to hilly and are deep. They are on moderately dissected to highly dissected plains and on alluvial and colluvial fans. These soils formed in calcareous loamy alluvium and colluvium. They are medium textured throughout.

Otero soils are gently undulating to hilly and are deep. They are on backslopes and foot slopes of breaks. These soils formed in calcareous loamy alluvium and colluvium. They are moderately coarse textured throughout.

Shingle soils are sloping to hilly and are shallow. They are on moderately dissected to highly dissected breaks. These soils formed in calcareous loamy or clayey residuum derived from shale. The surface layer is moderately fine textured, and the underlying material is fine textured. Shale is at a depth of 10 to 20 inches.

Of minor extent in this unit are well drained Olney, Renohill, Stoneham, Tassel, and Terry soils; excessively drained Cascajo soils; and Rock outcrop.

This unit is used as rangeland. The main limitations for this use are the hazards of soil blowing and water erosion. Management practices that conserve moisture, control runoff, and reduce soil blowing should be used.

loamy and gravelly soils on escarpments and associated alluvial and colluvial fans

This group consists of 3 map units. It makes up about 19 percent of the survey area. The soils in this group are nearly level to steep. The vegetation is mainly grasses, forbs, and shrubs. The average annual precipitation is 11 to 13 inches.

The soils in this group are shallow to deep and are well drained and excessively drained. They formed in calcareous loamy alluvium and colluvium and in calcareous loamy residuum derived from shale, sandstone, and siltstone.

Most areas of this group are used as rangeland. A few areas are used as nonirrigated cropland.

7. Argiustolls-Rock outcrop-Ustic Torriorthents

Rock outcrop and shallow to deep, well drained and excessively drained, nearly level to steep soils; on escarpments and colluvial fans

This map unit is in the northern half of the survey area. The western part is in the area known as "Chalk Bluffs," and the eastern part is in the area known as "Pawnee Buttes." Slopes are moderately dissected to highly dissected and are 0 to 40 percent. The vegetation is mainly grasses, forbs, and shrubs. Elevation is 5,000 to 6,100 feet.

This unit makes up about 5 percent of the survey area. It is about 48 percent Ustolls, 20 percent Rock outcrop, and 12 percent Ustic Torriorthents. The remaining 20 percent is components of minor extent.

Argiustolls are nearly level to sloping. They are on moderately dissected to highly dissected shoulders and

backslopes of colluvial fans. These soils formed in calcareous loamy colluvium. They are medium textured to moderately coarse textured throughout.

Rock outcrop consists of sloping exposed areas of rock that form the vertical facing of escarpments and the shoulders and backslopes of colluvial fans.

Ustic Torriorthents are gently sloping to steep. They are on moderately dissected to highly dissected shoulders and backslopes of colluvial fans. These soils formed in calcareous loamy colluvium. They are medium textured to moderately coarse textured throughout.

Of minor extent in this unit are the excessively drained Cascajo and Peetz soils and some areas of Badland.

This unit is used as rangeland and for wildlife habitat. The main limitations for these uses are the hazards of soil blowing and water erosion. Areas of Rock outcrop also limit use. Management practices that control soil blowing and reduce runoff should be used.

8. Epping-Thedalund-Keota

Shallow to moderately deep, well drained, nearly level to undulating soils; on alluvial and colluvial fans

This map unit is throughout the northern half of the survey area. Slopes are slightly dissected to highly dissected and are 0 to 9 percent. The vegetation is mainly grasses, forbs, and shrubs. Elevation is 5,000 to 5,500 feet.

This unit makes up about 4 percent of the survey area. It is about 60 percent Epping soils, 6 percent Thedalund soils, and 5 percent Keota soils. The remaining 29 percent is components of minor extent.

Epping soils are nearly level to sloping and are shallow. They are on moderately dissected to highly dissected foot slopes and toe slopes of alluvial and colluvial fans. These soils formed in calcareous loamy alluvium and colluvium. They are medium textured throughout.

Thedalund soils are nearly level to sloping and are moderately deep. They are on slightly dissected to moderately dissected foot slopes and toe slopes of alluvial and colluvial fans. These soils formed in calcareous loamy alluvium and colluvium. They are medium textured throughout.

Keota soils are nearly level to undulating and are moderately deep. They are on slightly dissected to moderately dissected foot slopes and toe slopes of alluvial and colluvial fans. These soils formed in calcareous loamy alluvium and colluvium. They are medium textured throughout.

Of minor extent in this unit are the well drained Kim, Mitchell, and Shingle soils, Badland, and Rock outcrop.

Most areas of this unit are used as rangeland. A few areas are used as nonirrigated cropland. Wheat, barley, and sorghum are the main cultivated crops. The main limitations for most uses are the hazards of soil blowing and water erosion. Management practices that conserve moisture, control runoff, and reduce soil blowing should be used.

9. Kim-Stoneham-Mitchell

Deep, well drained, nearly level to sloping soils; on alluvial and colluvial fans

This map unit is throughout the northern and eastern parts of the survey area. Slopes are slightly dissected to moderately dissected and are 0 to 9 percent. The vegetation is mainly grasses, forbs, and shrubs. Elevation is 4,800 to 5,500 feet.

This unit makes up about 10 percent of the survey area. It is about 28 percent Kim soils, 25 percent Stoneham soils, and 18 percent Mitchell soils. The remaining 29 percent is components of minor extent.

Kim soils are nearly level to gently undulating and are on foot slopes and toe slopes of fans. These soils formed in calcareous loamy alluvium and colluvium. They are medium textured throughout.

Stoneham soils are nearly level to gently undulating and are on foot slopes and toe slopes of fans. These soils formed in calcareous loamy alluvium and colluvium. The surface layer is medium textured. The subsoil is moderately fine textured.

Mitchell soils are nearly level to sloping and are on foot slopes and toe slopes of fans. These soils formed in calcareous loamy alluvium and colluvium. They are medium textured throughout.

Of minor extent in this unit are the well drained Epping, Keota, Otero, Shingle, and Thedalund soils.

This unit is used as rangeland and nonirrigated cropland. Wheat and sorghum are the main cultivated crops. The main limitations for most uses are the hazards of soil blowing and water erosion. Management practices that conserve moisture, control runoff, and reduce soil blowing should be used.

loamy and gravelly soils on ridges of high plains

This group consists of one map unit. It makes up about 9 percent of the survey area. The soils in this group are nearly level to hilly. The vegetation in areas not cultivated is mainly grasses, forbs, and shrubs. The average annual precipitation is 11 to 13 inches.

The soils in this group are deep and well drained to excessively drained. They formed in calcareous loamy and gravelly alluvium and colluvium.

This group is used as rangeland.

10. Ascalon-Peetz

Deep, well drained to excessively drained, nearly level to hilly soils; on ridges of high plains

This map unit is in the northern half of the survey area. Slopes are moderately dissected to highly dissected and are 0 to 30 percent. The vegetation on this unit is mainly grasses, forbs, and shrubs. Elevation is 5,000 to 6,100 feet.

This unit makes up about 9 percent of the survey area. It is about 53 percent Ascalon soils and 15 percent

Peetz soils. The remaining 32 percent is components of minor extent.

Ascalon soils are nearly level to rolling and are well drained. They are on slightly dissected to highly dissected foot slopes and toe slopes of ridges. These soils formed in calcareous loamy alluvium and colluvium. The surface layer is moderately coarse textured to medium textured. The subsoil is moderately fine textured.

Peetz soils are undulating to hilly and are excessively drained. They are on moderately dissected to highly dissected shoulders and backslopes of ridges. These soils formed in calcareous gravelly colluvium.

Of minor extent in this unit are well drained Bushman, Bresser, and Wages soils; somewhat excessively drained Blakeland soils; and excessively drained Cascajo soils.

This unit is used as rangeland. The main limitations for this use are the hazards of soil blowing and water erosion. Management practices that control soil blowing and reduce runoff should be used.

loamy soils mainly on high plains

This group consists of three map units. It makes up about 10 percent of the survey area. The soils in this group are nearly level to hilly. The vegetation in areas not cultivated is mainly grasses, forbs, and shrubs. The average annual precipitation is 11 to 14 inches.

The soils in this group are deep and well drained. They formed in calcareous loamy alluvium, calcareous gravelly alluvium, or loamy residuum derived from sandstone and limestone.

This group is used as nonirrigated and irrigated cropland and as rangeland.

11. Ascalon-Altvan

Deep, well drained, nearly level to rolling soils; on high plains

This map unit is in the north-central part of the survey area. Slopes are smooth to moderately dissected and are 0 to 9 percent. The vegetation is mainly grasses, forbs, and shrubs. Elevation is 5,300 to 5,500 feet.

This unit makes up about 4 percent of the survey area. It is about 37 percent Ascalon soils and 35 percent Altvan soils. The remaining 28 percent is components of minor extent.

Ascalon soils are nearly level to gently undulating. They are on slightly dissected to moderately dissected high plains. These soils formed in calcareous loamy alluvium. The surface layer is moderately coarse textured to medium textured. The subsoil is moderately fine textured.

Altvan soils are nearly level to gently undulating. They are on smooth to moderately dissected high plains. These soils formed in calcareous gravelly alluvium. The surface layer is moderately coarse textured. The subsoil is moderately fine textured. Sand and gravel are at a depth of 20 to 40 inches.

Of minor extent in this unit are the well drained Bushman, Curabith, Nucla, Nunn, Otero, and Wages soils and excessively drained Peetz soils.

This unit is used as nonirrigated and irrigated cropland and as rangeland. Wheat and sorghum are the main nonirrigated crops, and corn, pinto beans, and alfalfa are the main irrigated crops. The main limitations for most uses are the hazards of soil blowing and water erosion. Management practices that conserve moisture, control runoff, and reduce soil blowing should be used.

12. Ascalon-Bushman-Curabith

Deep, well drained, nearly level to hilly soils; on high plains and ridges

This map unit is in the northeastern part of the survey area. Slopes are slightly dissected to highly dissected and are 0 to 20 percent. The vegetation is mainly grasses, forbs, and shrubs. Elevation is 5,000 to 5,300 feet.

This unit makes up about 4 percent of the survey area. It is about 35 percent Ascalon soils, 19 percent Bushman soils, and 9 percent Curabith soils. The remaining 37 percent is components of minor extent.

Ascalon soils are nearly level to rolling and are on slightly dissected to highly dissected high plains. These soils formed in calcareous loamy alluvium. The surface layer is moderately coarse textured to medium textured. The subsoil is moderately fine textured.

Bushman soils are nearly level to rolling and are on moderately dissected to highly dissected high plains. These soils formed in calcareous loamy alluvium. They are moderately coarse textured throughout.

Curabith soils are nearly level to hilly and are on slightly dissected to highly dissected high plains and ridges. These soils formed in calcareous loamy alluvium derived from sandstone and limestone. They are medium textured to moderately coarse textured throughout.

Of minor extent in this unit are the well drained Eckley, Nucla, Nunn, Otero, Platner, and Wages soils.

This unit is used as nonirrigated cropland and rangeland. Wheat and sorghum are the main nonirrigated crops. The main limitations for most uses are the hazards of soil blowing and water erosion. Management practices that conserve moisture, control runoff, and reduce soil blowing should be used.

13. Rosebud-Curabith-Canyon

Shallow to deep, well drained, nearly level to hilly soils; on high plains, ridges, and breaks

This map unit is in the northeastern corner of the survey area. Slopes are slightly dissected to highly dissected and are 0 to 20 percent. The vegetation is mainly grasses and forbs and some shrubs. Elevation is 4,900 to 5,350 feet.

This unit makes up about 2 percent of the survey area. It is about 30 percent Rosebud soils, 15 percent

Curabith soils, and 10 percent Canyon soils. The remaining 45 percent is components of minor extent.

Rosebud soils are nearly level to gently undulating. They are moderately deep and are on moderately dissected to highly dissected high plains. These soils formed in calcareous loamy residuum derived from sandstone. The surface layer is moderately coarse textured to medium textured. The subsoil is moderately fine textured. Sandstone is at a depth of 20 to 40 inches.

Curabith soils are nearly level to hilly. They are deep and are on slightly dissected to highly dissected high plains and ridges. These soils formed in calcareous loamy alluvium derived from sandstone and limestone. The soils are medium textured to moderately coarse textured throughout.

Canyon soils are gently sloping to sloping. They are shallow and are on moderately dissected to highly dissected upland ridges and knolls. These soils formed in partially consolidated, limy, loamy residuum derived from sandstone. The soils are medium textured throughout. Sandstone is at a depth of 10 to 20 inches.

Of minor extent in this unit are well drained Ascalon, Bushman, Nunn, and Platner soils.

This unit is used as nonirrigated cropland and rangeland. Wheat and sorghum are the main nonirrigated crops. The main limitations for most uses are the hazards of soil blowing and water erosion. Management practices that conserve moisture, control runoff, and reduce soil blowing should be used.

detailed soil map units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and management of the soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Ascalon fine sandy loam, 0 to 6 percent slopes, is one of several phases in the Ascalon series.

Some map units are made up of two or more major soils. These map units are called soil complexes.

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Kim-Mitchell complex is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Badland is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

Table 1 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

map unit descriptions

1—Altvan fine sandy loam, 0 to 6 percent slopes. This deep, well drained soil is on smooth to moderately dissected plains. It formed in calcareous gravelly alluvium.

Typically, the surface layer is dark grayish brown fine sandy loam 6 inches thick. The subsoil is sandy clay loam 16 inches thick. The substratum is calcareous sandy clay loam 5 inches thick over gravelly coarse sand that extends to a depth of 60 inches or more. In some areas the surface layer is loam.

Included in this unit are small areas of Ascalon fine sandy loam, Peetz gravelly sandy loam, and Cascajo gravelly sandy loam.

Permeability of this Altvan soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of water erosion is slight to moderate. The hazard of soil blowing is moderate.

This unit is used for nonirrigated crops and as rangeland. Winter wheat is the main crop.

This unit is suited to winter wheat, barley, oats, and sorghum. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Precipitation usually is too low for crops on this unit to make efficient use of fertilizer.

Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Stubble mulch farming, stripcropping, and minimum tillage help to control erosion and conserve moisture. Terraces reduce runoff and the risk of erosion and help to conserve moisture.

The potential plant community on this unit is mainly blue grama, needleandthread, western wheatgrass, and prairie sandreed. The average annual production of air-dry vegetation ranges from 500 to 1,600 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass IVe, nonirrigated, and in Loamy Plains range site.

2—Altvan fine sandy loam, 6 to 9 percent slopes. This deep, well drained soil is on highly dissected plains. It formed in calcareous gravelly alluvium.

Typically, the surface layer is dark grayish brown fine sandy loam 3 inches thick. The subsoil is sandy clay loam 16 inches thick. The substratum is calcareous sandy clay loam 4 inches thick over gravelly coarse sand that extends to a depth of 60 inches or more. In some areas the surface layer is loam.

Included in this unit are small areas of Ascalon fine sandy loam, Peetz gravelly sandy loam, and Cascajo gravelly sandy loam.

Permeability of this Altvan soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

This unit is used as rangeland.

The potential plant community on this unit is mainly blue grama, needleandthread, western wheatgrass, and prairie sandreed. The average annual production of air-dry vegetation ranges from 400 to 1,400 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass VIe, nonirrigated, and in Loamy Plains range site.

3—Argiustolls-Rock outcrop complex, 0 to 9 percent slopes. This map unit is on slightly dissected to moderately dissected plains.

This unit is about 45 percent Argiustolls and about 35 percent Rock outcrop. The individual components of this unit are in areas so narrow that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Olney, Renohill, and Stoneham soils. Included areas make up about 20 percent of the total acreage.

Argiustolls are deep, well drained, dark-colored soils. The surface layer is loam, fine sandy loam, or silt loam. The subsoil is sandy clay loam, clay loam, or silty clay loam. The content of clay in the subsoil increases with depth. The substratum is calcareous loam, silt loam, or sandy loam.

Permeability of the Argiustolls is moderate. Available water capacity is moderate to high. Effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of water erosion is slight to high. The hazard of soil blowing is moderate.

Rock outcrop consists mainly of exposed areas of sandstone scattered throughout the unit.

This unit is used as rangeland.

The potential plant community on the Argiustolls is mainly blue grama, western wheatgrass, sedges, and buffalograss. The average annual production of air-dry vegetation ranges from 400 to 1,500 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is poorly suited to windbreaks and environmental plantings. It is limited mainly by the areas of Rock outcrop.

This map unit is in capability subclass VIs, nonirrigated. The Argiustolls are in Loamy Plains range site.

4—Ascalon fine sandy loam, 0 to 6 percent slopes. This deep, well drained soil is on smooth to moderately dissected plains. It formed in calcareous loamy alluvium.

Typically, the surface layer is dark brown fine sandy loam 8 inches thick. The subsoil is sandy clay loam 14 inches thick. The substratum to a depth of 60 inches or more is calcareous sandy loam. In some areas the surface layer is loam.

Included in this unit are small areas of Ascalon fine sandy loam that has slopes of 6 to 9 percent, Olney fine sandy loam, and Otero sandy loam. Also included are some areas of Rock outcrop.

Permeability of this Ascalon soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of water erosion is slight to moderate. The hazard of soil blowing is moderate.

This unit is used as nonirrigated cropland and rangeland. Winter wheat is the main crop.

This unit is well suited to winter wheat, barley, oats, and sorghum. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Precipitation usually is too low for crops on this unit to make efficient use of fertilizer.

Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Stubble-mulch farming, stripcropping, and minimum tillage help to control erosion and conserve moisture. Terraces reduce runoff and the risk of erosion and help to conserve moisture.

The potential plant community on this unit is mainly blue grama, western wheatgrass, sedges, and buffalograss. The average annual production of air-dry vegetation ranges from 500 to 1,500 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass IVe, nonirrigated, and in Loamy Plains range site.

5—Ascalon fine sandy loam, 6 to 9 percent slopes. This deep, well drained soil is on moderately dissected to highly dissected plains. It formed in calcareous loamy alluvium.

Typically, the surface layer is dark brown fine sandy loam 6 inches thick. The subsoil is sandy clay loam 15 inches thick. The substratum to a depth of 60 inches or more is calcareous sandy loam. In some areas the surface layer is loam.

Included in this unit are small areas of Altvan fine sandy loam, Cascajo gravelly sandy loam, and Peetz gravelly sandy loam. Also included are some areas of Rock outcrop.

Permeability of this Ascalon soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

This unit is used as rangeland and nonirrigated cropland. Areas of nonirrigated cropland are poorly suited for use as rangeland and should be seeded to adapted grasses.

The potential plant community on this unit is mainly blue grama, western wheatgrass, sedges, and buffalograss. The average annual production of air-dry vegetation ranges from 400 to 1,300 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass VIe, nonirrigated, and in Loamy Plains range site.

6—Ascalon-Blakeland complex, 3 to 15 percent slopes. This map unit is on alluvial and colluvial fans and on moderately dissected to highly dissected plains.

This unit is 50 percent Ascalon fine sandy loam and 30 percent Blakeland loamy sand. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit is about 20 percent Bushman fine sandy loam, Bresser sandy loam, and Wages fine sandy loam.

The Ascalon soil is deep and well drained. It formed in calcareous loamy alluvium. Typically, the surface layer is dark brown fine sandy loam 8 inches thick. The subsoil is sandy clay loam 18 inches thick. The substratum to a depth of 60 inches or more is calcareous sandy loam. In some areas the surface layer is loam.

Permeability of the Ascalon soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of water erosion is slight to very high. The hazard of soil blowing is moderate.

The Blakeland soil is deep and somewhat excessively drained. It formed in arkosic sandy alluvium and colluvium. Typically, the surface layer is dark grayish brown loamy sand 15 inches thick. The underlying material to a depth of 60 inches or more is loamy sand.

Permeability of the Blakeland soil is rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This unit is used as rangeland.

The potential plant community on the Ascalon soil is mainly blue grama, western wheatgrass, sedges, and buffalograss. The average annual production of air-dry vegetation ranges from 400 to 1,300 pounds. The potential plant community on the Blakeland soil is mainly blue grama, sand bluestem, prairie sandreed, and needleandthread. The average annual production of air-dry vegetation ranges from 700 to 1,800 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce plants suitable for grazing.

This unit is poorly suited to windbreaks and environmental plantings. The main limitations are moderate available water capacity and steepness of slope. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass VIe, nonirrigated. The Ascalon soil is in Loamy Plains range site, and the Blakeland soil is in Deep Sand range site.

7—Ascalon-Bushman-Curabith complex, 0 to 3 percent slopes. This map unit is on smooth to slightly dissected plains and on upland ridges.

This unit is 35 percent Ascalon fine sandy loam, 30 percent Bushman fine sandy loam, and 15 percent Curabith loam. The individual components of this unit are in areas so narrow that it was not practical to map them separately at the scale used.

Included in this unit is about 20 percent Nucla loam, Wages fine sandy loam, Nunn loam, and Platner loam. Also included are some areas of Rock outcrop.

The Ascalon soil is deep and well drained. It formed in calcareous loamy alluvium. Typically, the surface layer is dark brown fine sandy loam 8 inches thick. The subsoil is sandy clay loam 18 inches thick. The substratum to a depth of 60 inches or more is calcareous sandy loam. In some areas the surface layer is loam.

Permeability of the Ascalon soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

The Bushman soil is deep and well drained. It formed in calcareous loamy alluvium. Typically, the surface layer is brown fine sandy loam 10 inches thick. The underlying material to a depth of 60 inches or more is calcareous sandy loam.

Permeability of the Bushman soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

The Curabith soil is deep and well drained. It formed in calcareous loamy alluvium. Typically, the surface layer is dark grayish brown loam 10 inches thick. The upper 15 inches of the underlying material is very channery sandy loam, the next 17 inches is channery sandy loam, and the lower part to a depth of 60 inches or more is very channery loamy sand. The soil is calcareous throughout.

Permeability of the Curabith soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is slight.

This unit is used as rangeland and nonirrigated cropland. Winter wheat is the main crop.

The potential plant community on the Ascalon soil is mainly blue grama, western wheatgrass, sedges, and buffalograss. The average annual production of air-dry vegetation ranges from 400 to 1,400 pounds. The potential plant community on the Bushman soil is mainly blue grama, needleandthread, and prairie sandreed. The average annual production of air-dry vegetation ranges from 700 to 1,800 pounds. The potential plant community on the Curabith soil is mainly blue grama, little bluestem, sideoats grama, and prairie sandreed. The average annual production of air-dry vegetation ranges from 600 to 1,300 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or

both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce plants suitable for grazing.

This unit is suited to winter wheat, barley, oats, and sorghum. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Precipitation usually is too low for crops on this unit to make efficient use of fertilizer.

Maintaining crop residue on or near the surface reduces soil blowing and helps to maintain soil tilth and organic matter content. Stubble-mulch farming, stripcropping, and minimum tillage help to control erosion and conserve moisture. Terraces reduce the risk of erosion and help to conserve moisture.

This unit is well suited to windbreaks and environmental plantings. Supplemental irrigation may be needed when planting and during dry periods. Soil blowing can be reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows.

This map unit is in capability subclass IVe, nonirrigated. The Ascalon soil is in Loamy Plains range site, the Bushman soil is in Sandy Plains range site, and the Curabith soil is in Limestone Breaks range site.

8—Ascalon-Bushman-Curabith complex, 3 to 15 percent slopes. This map unit is on moderately dissected plains and on upland ridges.

This unit is 35 percent Ascalon fine sandy loam, 25 percent Bushman fine sandy loam, and 20 percent Curabith loam. The individual components of this unit are in areas so narrow that it was not practical to map them separately at the scale used.

Included in this unit is about 20 percent Nucla loam, Wages fine sandy loam, Nunn loam, and Platner loam. Also included are some areas of Rock outcrop.

The Ascalon soil is deep and well drained. It formed in calcareous loamy alluvium. Typically, the surface layer is dark brown fine sandy loam 8 inches thick. The subsoil is sandy clay loam 18 inches thick. The substratum to a depth of 60 inches or more is calcareous sandy loam. In some areas the surface layer is loam.

Permeability of the Ascalon soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate to high. The hazard of soil blowing is moderate.

The Bushman soil is deep and well drained. It formed in calcareous loamy alluvium. Typically, the surface layer is brown fine sandy loam 10 inches thick. The underlying material to a depth of 60 inches or more is calcareous sandy loam.

Permeability of the Bushman soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate to high. The hazard of soil blowing is moderate.

The Curabith soil is deep and well drained. It formed in calcareous loamy alluvium. Typically, the surface layer is dark grayish brown loam 10 inches thick. The upper 15 inches of the underlying material is very channery sandy loam, the next 17 inches is channery sandy loam, and the lower part to a depth of 60 inches is very channery loamy sand. The soil is calcareous throughout.

Permeability of the Curabith soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate to very high.

This unit is used as rangeland.

The potential plant community on the Ascalon soil is mainly blue grama, western wheatgrass, sedges, and buffalograss. The average annual production of air-dry vegetation ranges from 400 to 1,400 pounds. The potential plant community on the Bushman soil is mainly blue grama, needleandthread, and prairie sandreed. The average annual production of air-dry vegetation ranges from 700 to 1,800 pounds. The potential plant community on the Curabith soil is mainly blue grama, little bluestem, sideoats grama, and prairie sandreed. The average annual production of air-dry vegetation ranges from 600 to 1,300 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce plants suitable for grazing.

The Ascalon soil is well suited to windbreaks and environmental plantings. Supplemental irrigation may be needed when planting and during dry periods.

The Bushman soil is poorly suited to windbreaks and environmental plantings. The main limitations are the moderate available water capacity and the hazard of soil blowing if the soil is barren of vegetation. Soil blowing can be reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows.

The Curabith soil is poorly suited to windbreaks and environmental plantings. The main limitations are the moderate available water capacity and steepness of slope.

This map unit is in capability subclass VIe, nonirrigated. The Ascalon soil is in Loamy Plains range

site, the Bushman soil is in Sandy Plains range site, and the Curabith soil is in Limestone Breaks range site.

9—Avar fine sandy loam. This deep, well drained soil is on flood plains, in swales, and on terraces adjacent to flood plains. It formed in calcareous loamy alluvium. Slope is 0 to 3 percent.

Typically, the surface layer is light brownish gray fine sandy loam 3 inches thick. The upper 5 inches of the subsoil is clay loam, and the lower 3 inches is sandy clay loam. The upper 12 inches of the substratum is sandy loam, and the lower part to a depth of 60 inches or more is sandy clay loam. In some areas the surface layer is very fine sandy loam, sandy loam, or loamy sand.

Included in this unit are soils that are similar to this Avar soil but have a dark-colored surface layer as much as 10 inches thick, have a clay loam or clay subsoil 10 inches thick or more, or have a light-colored surface layer. Also included are numerous barren areas and slick spots, small areas of Ascalon and Nunn soils on terraces, and small areas of Bankard and Haverson soils on flood plains. Included areas make up about 35 percent of the total acreage.

Permeability of this Avar soil is very slow in the upper part and moderate in the lower part. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight. The hazard of soil blowing is moderate. The subsoil and substratum are strongly alkaline and saline.

This unit is used as rangeland.

The potential plant community on this unit is mainly alkali sacaton, blue grama, inland saltgrass, and western wheatgrass. The average annual production of air-dry vegetation ranges from 500 to 1,500 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Salt-tolerant grasses can be grown. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Livestock grazing should be managed to protect the unit from erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce plants suitable for grazing.

This unit is poorly suited to windbreaks and environmental plantings. The main limitations are restricted root growth and decreased available water capacity because of the strong alkalinity and salinity of the subsoil and substratum.

This map unit is in capability subclass VIs, nonirrigated, and in Salt Flat range site.

10—Avar-Manzanola complex, 0 to 3 percent slopes. This map unit is in swales.

This unit is about 45 percent Avar fine sandy loam and 40 percent Manzanola clay loam. The Avar soil is on the perimeter of closed swales, and the Manzanola soil is in the lower lying or depressional areas. The individual components of this unit are in areas so narrow that it was not practical to map them separately at the scale used.

Included in this unit are small areas of poorly drained soils and soils that have a thicker surface layer and subsoil than the Avar and Manzanola soils. Included areas make up about 15 percent of the total acreage. The percentage varies from one area to another.

The Avar soil is deep and well drained. It formed in calcareous loamy alluvium. Typically, the surface layer is light brownish gray fine sandy loam 3 inches thick. The upper 5 inches of the subsoil is brown clay loam, and the lower 3 inches is brown sandy clay loam. The upper 12 inches of the substratum is pale brown sandy loam, and the lower part to a depth of 60 inches or more is pale brown or very pale brown sandy clay loam. In some areas the surface layer is very fine sandy loam or sandy loam. The soil is calcareous throughout.

Permeability of the Avar soil is very slow in the upper part and moderate in the lower part. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight. The hazard of soil blowing is moderate. The subsoil and substratum are strongly alkaline and saline.

The Manzanola soil is deep and well drained. It formed in calcareous clayey alluvium. Typically, the surface layer is grayish brown clay loam 3 inches thick. The subsoil is calcareous clay 15 inches thick. The substratum to a depth of 60 inches or more is calcareous clay or clay loam.

Permeability of the Manzanola soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium to slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This unit is used as rangeland.

The potential plant community on the Avar soil is mainly alkali sacaton, blue grama, inland saltgrass, and western wheatgrass. The average annual production of air-dry vegetation ranges from 500 to 1,500 pounds. The potential plant community on the Manzanola soil is mainly blue grama, western wheatgrass, and fourwing saltbush. The average annual production of air-dry vegetation ranges from 500 to 1,200 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet

the seasonal requirements of livestock or wildlife, or both. Salt-tolerant grasses can be grown. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Livestock grazing should be managed to protect the soil in this unit from excessive erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce plants suitable for grazing.

The Avar soil is poorly suited to windbreaks and environmental plantings. The main limitations are restricted root growth and decreased available water capacity because of the strong alkalinity and salinity of the subsoil and substratum.

The Manzanola soil is well suited to windbreaks and environmental plantings. It has few limitations. Supplemental irrigation may be needed when planting and during dry periods. Summer fallow, cultivation for weed control, and selection of adapted plants are needed to insure establishment and survival of seedlings.

This map unit is in capability subclass VIs, nonirrigated. The Avar soil is in Salt Flat range site, and the Manzanola soil is in Clayey Plains range site.

11—Badland. Badland is mainly in the northern part of the survey area. It consists of gently sloping to steep areas dissected by many intermittent channels that are entrenched in calcareous soft siltstone, soft claystone, and fine-grained sandstone of the White River Formation. About 75 percent or more of the unit is barren. Runoff is very high, and the hazard of erosion is very high.

Included in this unit are small areas of Kim and Mitchell soils, Thedalund and Keota loams, Shingle clay loam, Epping silt loam, and Haverson loam. These soils support some vegetation that has limited value for livestock grazing and wildlife habitat.

This map unit is in capability subclass VIIIe, nonirrigated.

12—Bankard loamy fine sand, 0 to 3 percent slopes. This deep, well drained to somewhat excessively drained soil is on flood plains. It formed in stratified, calcareous sandy alluvium.

Typically, the surface layer is brown loamy fine sand 6 inches thick. The upper part of the underlying material is loamy sand and sand 28 inches thick, and the lower part to a depth of 60 inches or more is gravelly sand and very gravelly sand that is stratified with thin lenses of sand, sandy loam, and loam. In some areas the surface layer is sandy loam or loam.

Included in this unit are small areas of sand and gravel bars.

Permeability of this Bankard soil is rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high. This soil is subject to brief periods of flooding in spring and summer.

This unit is used as rangeland.

The potential plant community on this unit is mainly switchgrass, Indiangrass, sand bluestem, and prairie sandreed. The average annual production of air-dry vegetation ranges from 1,200 to 2,500 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Livestock grazing should be managed to protect the soil in this unit from excessive erosion.

This unit is poorly suited to windbreaks and environmental plantings.

This map unit is in capability subclass VIw, nonirrigated, and in Sandy Bottomland range site.

13—Blakeland loamy sand, 0 to 6 percent slopes. This deep, somewhat excessively drained soil is on alluvial and colluvial fans. It formed in arkosic sandy alluvium and colluvium.

Typically, the surface layer is dark grayish brown loamy sand 15 inches thick. The underlying material to a depth of 60 inches or more is loamy sand.

Included in this unit are small areas of Bushman fine sandy loam, Bresser sandy loam, and Paoli fine sandy loam. Included areas make up about 15 percent of the total acreage.

Permeability of this Blakeland soil is rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

This unit is used as rangeland.

The potential plant community on this unit is mainly blue grama, sand bluestem, prairie sandreed, and needleandthread. The average annual production of air-dry vegetation ranges from 800 to 2,000 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed,

protection from soil blowing is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. The main limitations are the moderate available water capacity and the hazard of soil blowing. Trees need to be planted among the native vegetation to minimize disturbance of the plant cover. Supplemental irrigation may be needed when planting and during dry periods.

This unit is suited to urban development. It has few limitations.

This map unit is in capability subclass VIe, nonirrigated, and in Deep Sand range site.

14—Blakeland loamy sand, 6 to 12 percent slopes. This deep, somewhat excessively drained soil is on alluvial and colluvial fans. It formed in arkosic sandy alluvium and colluvium.

Typically, the surface layer is dark grayish brown loamy sand 12 inches thick. The underlying material to a depth of 60 inches or more is loamy sand.

Included in this unit are small areas of Bushman fine sandy loam, Bresser sandy loam, and Eckley sandy clay loam. Included areas make up about 15 percent of the total acreage.

Permeability of this Blakeland soil is rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is moderate to high. The hazard of soil blowing is high.

This unit is used as rangeland.

The potential plant community on this unit is mainly blue grama, sand bluestem, prairie sandreed, and needleandthread. The average annual production of air-dry vegetation ranges from 700 to 1,800 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. The main limitations are the moderate available water capacity and the high hazard of soil blowing. Trees need to be planted among the native vegetation to minimize disturbance of the plant cover. Supplemental irrigation may be needed when planting and during dry periods.

This unit is moderately to severely limited for urban development, mainly because of steepness of slope.

This map unit is in capability subclass VIe, nonirrigated, and in Deep Sand range site.

15—Bresser sandy loam, 0 to 3 percent slopes. This deep, well drained soil is on smooth to moderately dissected high plains. It formed in sandy alluvium.

Typically, the surface layer is dark grayish brown coarse sandy loam 15 inches thick. The subsoil is sandy clay loam 22 inches thick. The substratum to a depth of 60 inches or more is loamy coarse sand. In some areas the surface layer is loamy coarse sand.

Included in this unit are small areas of Altvan fine sandy loam.

Permeability of this Bresser soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This unit is used as nonirrigated cropland and rangeland. Winter wheat is the main crop.

This unit is well suited to winter wheat, barley, oats, and sorghum. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Precipitation usually is too low for crops on this unit to make efficient use of fertilizer.

Maintaining crop residue on or near the surface reduces soil blowing and helps to maintain soil tilth and organic matter content. Stubble-mulch farming, stripcropping, and minimum tillage help to control erosion and conserve moisture. Terraces reduce runoff and the risk of erosion and help to conserve moisture.

The potential plant community on this unit is mainly blue grama, needleandthread, and prairie sandreed. The average annual production of air-dry vegetation ranges from 800 to 2,000 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass IVe, nonirrigated, and in Sandy Plains range site.

16—Bresser sandy loam, 3 to 9 percent slopes. This deep, well drained soil is on highly dissected high plains. It formed in sandy alluvium.

Typically, the surface layer is dark grayish brown coarse sandy loam 15 inches thick. The subsoil is sandy clay loam 19 inches thick. The substratum to a depth of 60 inches or more is loamy coarse sand. In some areas the surface layer is loamy coarse sand.

Included in this unit are small areas of Altvan fine sandy loam.

Permeability of this Bresser soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate to high. The hazard of soil blowing is moderate.

This unit is used as rangeland.

The potential plant community on this unit is mainly blue grama, needleandthread, and prairie sandreed. The average annual production of air-dry vegetation ranges from 700 to 1,800 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass VIe, nonirrigated, and in Sandy Plains range site.

17—Bushman fine sandy loam, 0 to 3 percent slopes. This deep, well drained soil is on slightly dissected alluvial fans. It formed in calcareous loamy alluvium.

Typically, the surface layer is brown fine sandy loam 10 inches thick. Below this to a depth of 60 inches or more is sandy loam.

Included in this unit are small areas of Wages fine sandy loam.

Permeability of this Bushman soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This unit is used as rangeland and nonirrigated cropland. Winter wheat is the main crop.

The potential plant community on this unit is mainly blue grama, needleandthread, and prairie sandreed. The average annual production of air-dry vegetation ranges from 700 to 1,800 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from soil blowing is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is suited to winter wheat, barley, oats, and sorghum. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Precipitation usually is too low for crops on this unit to make efficient use of fertilizer.

Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Stubble-mulch farming, stripcropping, and minimum tillage help to control erosion and conserve moisture. Terraces reduce runoff and the risk of erosion and help to conserve moisture.

This unit is well suited to windbreaks and environmental plantings. Soil blowing can be reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass IVe, nonirrigated, and in Sandy Plains range site.

18—Bushman fine sandy loam, 3 to 9 percent slopes. This deep, well drained soil is on moderately dissected to highly dissected alluvial and colluvial fans. It formed in calcareous loamy alluvium and colluvium.

Typically, the surface layer is brown fine sandy loam 6 inches thick. Below this to a depth of 60 inches or more is sandy loam.

Included in this unit are small areas of Wages fine sandy loam.

Permeability of this Bushman soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate to high. The hazard of soil blowing is moderate.

This unit is used as rangeland.

The potential plant community on this unit is mainly blue grama, needleandthread, and prairie sandreed. The average annual production of air-dry vegetation ranges from 600 to 1,700 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. Soil blowing can be reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass VIe, nonirrigated, and in Sandy Plains range site.

19—Bushman-Curabith-Canyon complex, 0 to 20 percent slopes. This map unit is on upland ridges, breaks, and knolls.

This unit is 45 percent Bushman fine sandy loam, 30 percent Curabith loam, and 20 percent Canyon gravelly loam. The Bushman soil is on backslopes and foot slopes of upland ridges. The Curabith and Canyon soils are on shoulders of upland ridges and on breaks and knolls. Slopes are moderately dissected and convex on the shoulders and are slightly dissected to moderately dissected and concave on the backslopes and foot slopes. The individual components of this unit are in areas so narrow that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Ascalon fine sandy loam on backslopes and foot slopes of upland ridges and Nunn and Haverson loams in small drainageways dissecting upland ridges. Also included are some areas of Rock outcrop. Included areas make up about 5 percent of the total acreage.

The Bushman soil is deep and well drained. It formed in calcareous loamy alluvium. Typically, the surface layer is brown fine sandy loam 6 inches thick. Below this to a depth of 60 inches or more is calcareous sandy loam.

Permeability of the Bushman soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight to high. The hazard of soil blowing is moderate.

The Curabith soil is deep and well drained. It formed in calcareous loamy alluvium. Typically, the surface layer is dark grayish brown loam 10 inches thick. The upper 15 inches of the underlying material is very channery sandy loam, the next 17 inches is channery sandy loam, and the lower part to a depth of 60 inches or more is very channery loamy sand. The soil is calcareous throughout.

Permeability of the Curabith soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight to very high. The hazard of soil blowing is slight.

The Canyon soil is shallow and well drained. It formed in calcareous loamy residuum derived from sandstone. Typically, the surface layer is dark grayish brown gravelly loam 3 inches thick. Below this is gravelly loam 11 inches thick. Sandstone is at a depth of 14 inches. Depth to sandstone ranges from 10 to 20 inches. The soil is calcareous throughout.

Permeability of the Canyon soil is moderate. Available water capacity is low. Effective rooting depth is 10 to 20 inches. Runoff is slow, and the hazard of water erosion is moderate to high. The hazard of soil blowing is slight.

This unit is used as rangeland.

The potential plant community on the Bushman soil is mainly blue grama, western wheatgrass, needleandthread, and little bluestem. The average annual production of air-dry vegetation ranges from 700 to 1,800 pounds. The potential plant community on the Curabith and Canyon soils is mainly blue grama, little bluestem, sideoats grama, and sedges. The average annual production of air-dry vegetation ranges from 500 to 1,200 pounds on the Curabith soil and from 400 to 1,000 pounds on the Canyon soil.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce plants suitable for grazing.

This unit is poorly suited to windbreaks and environmental planting.

This map unit is in capability subclass VIs, nonirrigated. The Bushman soil is in Sandy Plains range site, and the Curabith and Canyon soils are in Limestone Breaks range site.

20—Cascajo gravelly sandy loam, 5 to 20 percent slopes. This deep, excessively drained soil is on backslopes and shoulders of moderately dissected to highly dissected upland ridges and breaks. It formed in calcareous gravelly alluvium. Slopes are concave. Areas are long and narrow and are 20 to 1,000 acres.

Typically, 15 to 35 percent of the surface is covered with gravel and cobbles. The surface layer is dark

grayish brown gravelly sandy loam 3 inches thick. The next layer is calcareous very gravelly loamy coarse sand 21 inches thick. Below this to a depth of 60 inches or more is calcareous very gravelly loamy coarse sand.

Included in this unit are small areas of soils, on backslopes, shoulders, and crests of upland ridges and breaks, that have fine-grained sandstone or siltstone at a depth of 20 to 40 inches; Rock outcrop on shoulders and crests of upland ridges and breaks; and Otero sandy loam and Stoneham fine sandy loam on the lower parts of backslopes and on upland ridges and breaks. Included areas make up about 25 percent of the total acreage. The percentage varies from one area to another.

Permeability of this Cascajo soil is moderately rapid to a depth of 3 inches and rapid below this depth. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate to very high. The hazard of soil blowing is slight.

Most areas of this unit are used as rangeland. A few areas are used as a source of gravel.

The potential plant community on this unit is mainly blue grama, little bluestem, sideoats grama, and prairie sandreed. The average annual production of air-dry vegetation ranges from 500 to 1,200 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Areas that are heavily infested with undesirable plants can be improved by proper grazing management. Management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Mechanical treatment is not practical because of the stony surface and the steepness of slope. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil in this unit to produce plants suitable for grazing. Slope limits access by livestock and results in overgrazing of the less sloping areas.

This unit is poorly suited to windbreaks and environmental plantings. The main limitations are the large accumulations of lime and moderate available water capacity. Supplemental irrigation may be needed when planting and during dry periods. Summer fallow, cultivation for weed control, and selection of adapted plants are needed to insure establishment and survival of seedlings.

This map unit is in capability subclass VIIs, nonirrigated, and in Gravel Breaks range site.

21—Cushman fine sandy loam, 0 to 6 percent slopes. This moderately deep, well drained soil is on slightly dissected to moderately dissected plains. It formed in calcareous loamy residuum derived from interbedded sandstone and shale.

Typically, the surface layer is brown fine sandy loam 6 inches thick. The upper 4 inches of the subsoil is fine sandy loam, and the lower 11 inches is clay loam. The substratum is calcareous clay loam 8 inches thick. Interbedded, calcareous sandstone and shale are at a depth of 29 inches. Depth to sandstone and shale ranges from 20 to 40 inches.

Included in this unit are small areas of Midway clay loam, Renohill fine sandy loam, and Shingle clay loam. Also included are some areas of Rock outcrop.

Permeability of this Cushman soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is slight to moderate. The hazard of soil blowing is slight.

This unit is used as rangeland and nonirrigated cropland. Winter wheat is the main crop.

The potential plant community on this unit is mainly blue grama, western wheatgrass, sedges, and buffalograss. The average annual production of air-dry vegetation ranges from 500 to 1,500 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is suited to winter wheat, barley, oats, and sorghum. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Precipitation usually is too low for crops on this unit to make efficient use of fertilizer.

Maintaining crop residue on or near the surface reduces erosion and helps to maintain soil tilth and organic matter content. Stubble-mulch farming, stripcropping, and minimum tillage help to control erosion and conserve moisture. Terraces reduce runoff and the risk of erosion and help to conserve moisture.

This unit is well suited to windbreaks and environmental plantings. The main limitations are the moderate available water capacity and restricted rooting depth. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass IVe, nonirrigated, and in Loamy Plains range site.

22—Cushman fine sandy loam, 6 to 9 percent slopes. This moderately deep, well drained soil is on moderately dissected to highly dissected plains. It formed in calcareous loamy residuum derived from interbedded sandstone and shale.

Typically, the surface layer is brown fine sandy loam 6 inches thick. The upper 4 inches of the subsoil is fine sandy loam, and the lower 11 inches is clay loam. The substratum is calcareous clay loam 8 inches thick. Interbedded, calcareous sandstone and shale are at a depth of 29 inches. Depth to sandstone and shale ranges from 20 to 40 inches.

Included in this unit are small areas of Midway clay loam, Renohill fine sandy loam, and Shingle clay loam. Also included are some areas of Rock outcrop.

Permeability of this Cushman soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate to high. The hazard of soil blowing is slight.

This unit is used as rangeland.

The potential plant community on this unit is mainly blue grama, western wheatgrass, sedges, and buffalograss. The average annual production of air-dry vegetation ranges from 400 to 1,300 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. The main limitations are the moderate available water capacity and restricted rooting depth. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass VIe, nonirrigated, and in Loamy Plains range site.

23—Dacono clay loam, 0 to 6 percent slopes. This deep, well drained soil is on plains and adjacent stream terraces. It formed in calcareous loamy alluvium.

Typically, the surface layer is dark grayish brown clay loam 4 inches thick. The upper 3 inches of the subsoil is clay loam, and the lower 8 inches is clay. The upper part of the substratum is calcareous clay loam 6 inches thick, and the lower part to a depth of 60 inches or more is sandy clay loam over calcareous very gravelly loamy sand and sand.

Included in this unit are small areas of Haverson loam, Nunn clay loam, and Nunn loam.

Permeability of this Dacono soil is moderately slow. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight to moderate. The hazard of soil blowing is slight.

This unit is used as nonirrigated cropland and rangeland. Winter wheat is the main crop.

This unit is well suited to winter wheat, barley, oats, and sorghum. The fine texture of the surface layer limits the crops that can be grown on this unit. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Precipitation usually is too low for crops on this unit to make efficient use of fertilizer.

Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Stubble-mulch farming, stripcropping, and minimum tillage help to control erosion and conserve moisture. Terraces reduce runoff and the risk of erosion and help to conserve moisture.

The potential plant community on this unit is mainly blue grama, western wheatgrass, fourwing saltbush, and buffalograss. The average annual production of air-dry vegetation ranges from 400 to 1,300 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass IVe, nonirrigated, and in Clayey Plains range site.

24—Eckley sandy clay loam, 0 to 6 percent slopes. This deep, well drained soil is on smooth to moderately dissected plains and on shoulders of upland ridges. It formed in gravelly alluvium.

Typically, the surface layer is dark grayish brown sandy clay loam 9 inches thick. The subsoil is sandy clay loam and gravelly sandy clay loam 6 inches thick. The substratum to a depth of 60 inches or more is gravelly sand. In some areas the surface layer is sandy loam.

Included in this unit are small areas of Altvan fine sandy loam, Ascalon fine sandy loam, and Bresser sandy loam.

Permeability of this Eckley soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight to moderate. The hazard of soil blowing is slight.

This unit is used as nonirrigated cropland and rangeland. Winter wheat is the main crop.

This unit is suited to winter wheat, barley, oats, and sorghum. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Precipitation usually is too low for crops on this unit to make efficient use of fertilizer.

Maintaining crop residue on or near the surface reduces soil blowing and helps to maintain soil tilth and organic matter content. Stubble-mulch farming, stripcropping, and minimum tillage help to control erosion and conserve moisture. Terraces reduce runoff and the risk of erosion and help to conserve moisture.

The potential plant community on this unit is mainly blue grama, sideoats grama, and little bluestem. The average annual production of air-dry vegetation ranges from 700 to 1,400 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is suited to windbreaks and environmental plantings. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass IVe, nonirrigated, and in Sandy Plains range site.

25—Eckley sandy clay loam, 6 to 9 percent slopes. This deep, well drained soil is on backslopes and shoulders of moderately dissected to highly dissected upland ridges and plains. It formed in gravelly alluvium.

Typically, the surface layer is dark grayish brown sandy clay loam 8 inches thick. The subsoil is sandy clay loam 6 inches thick. The substratum to a depth of 60 inches or more is gravelly sand. In some areas the surface layer is gravelly sandy loam.

Included in this unit are small areas of Altvan fine sandy loam, Ascalon fine sandy loam, Blakeland loamy sand, and Bresser sandy loam.

Permeability of this Eckley soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of water erosion is moderate to high. The hazard of soil blowing is slight.

This unit is used as rangeland.

The potential plant community on this unit is mainly blue grama, sideoats grama, and little bluestem. The average annual production of air-dry vegetation ranges from 600 to 1,200 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Livestock grazing should be managed to protect the soil in this unit from erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is suited to windbreaks and environmental plantings. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass VIe, nonirrigated, and in Sandy Plains range site.

26—Eckley-Dix-Blakeland complex, 6 to 20 percent slopes. This map unit is on moderately dissected to highly dissected upland ridges and breaks.

This unit is 35 percent Eckley sandy clay loam, 25 percent Dix gravelly loamy sand, and 20 percent Blakeland loamy sand. The individual components of this unit are in areas so narrow that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Ascalon fine sandy loam, Bresser sandy loam, and Manter sandy loam. Included areas make up 20 percent of the total acreage.

The Eckley soil is deep and well drained. It formed in gravelly alluvium. Typically, the surface layer is dark grayish brown sandy clay loam 8 inches thick. The subsoil is sandy clay loam 6 inches thick. The substratum to a depth of 60 inches or more is gravelly sand. In some areas the surface layer is gravelly sandy loam.

Permeability of the Eckley soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of water erosion is moderate to very high. The hazard of soil blowing is slight.

The Dix soil is deep and excessively drained. It formed in gravelly alluvium. Typically, 15 to 25 percent of the surface is covered with gravel. The surface layer is dark grayish brown gravelly loamy sand 12 inches thick. Below this to a depth of 60 inches or more is gravelly and very gravelly sand.

Permeability of the Dix soil is rapid to a depth of 37 inches and very rapid below this depth. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

The Blakeland soil is deep and somewhat excessively drained. It formed in arkosic sandy alluvium and colluvium. Typically, the surface layer is dark grayish brown loamy sand 12 inches thick. The underlying material to a depth of 60 inches or more is loamy sand.

Permeability of the Blakeland soil is rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is moderate to very high. The hazard of soil blowing is high.

This unit is used as rangeland.

The potential plant community on the Eckley soil is mainly blue grama, sideoats grama, and little bluestem. The average annual production of air-dry vegetation ranges from 400 to 1,200 pounds. The potential plant community on the Dix soil is mainly blue grama, little bluestem, sideoats grama, and prairie sandreed. The average annual production of air-dry vegetation ranges from 400 to 1,200 pounds. The potential plant community on the Blakeland soil is mainly blue grama, little bluestem, prairie sandreed, and sand dropseed. The average annual production of air-dry vegetation ranges from 700 to 1,800 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Slope limits access by livestock and results in overgrazing of the less sloping areas. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce plants suitable for grazing.

Management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Mechanical treatment is not practical because of the stony surface and the steepness of slope.

This unit is suited to windbreaks and environmental plantings.

This map unit is in capability subclass VIe, nonirrigated. The Eckley and Dix soils are in Gravel Breaks range site, and the Blakeland soil is in Deep Sand range site.

27—Epping silt loam, 0 to 9 percent slopes. This shallow, well drained soil is on slightly dissected to highly dissected plains. It formed in calcareous loamy residuum derived from siltstone.

Typically, the surface layer is light brownish gray silt loam 3 inches thick. The underlying material is silt loam 14 inches thick. Siltstone is at a depth of 17 inches. Depth to siltstone ranges from 10 to 20 inches. In some areas the surface layer is loam.

Included in this unit are small areas of Keota loam, Kim loam, Mitchell silt loam, and Thedalund loam. Also included are some areas of Rock outcrop. Included areas make up about 20 percent of the total acreage.

Permeability of this Epping soil is moderate. Available water capacity is low. Effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is slight to very high. The hazard of soil blowing is moderate.

This unit is used as rangeland.

The potential plant community on this unit is mainly blue grama, winterfat, western wheatgrass, and fourwing saltbush. The average annual production of air-dry vegetation ranges from 500 to 1,000 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is poorly suited to windbreaks and environmental plantings. The main limitation is shallow rooting depth.

This map unit is in capability subclass VIe, nonirrigated, and in Shallow Siltstone range site.

28—Haplaquolls-Fluvaquents complex, frequently flooded. This map unit is on smooth plains, in depressional areas, and along the bottom of natural drainageways. The soils in this unit are poorly drained and very poorly drained. Areas are ponded periodically because of runoff in spring and from irrigation. Slope is 0 to 2 percent. The native vegetation is mainly grasses, shrubs, and trees.

This unit is about 45 percent Haplaquolls and about 45 percent Fluvaquents. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of well drained and moderately well drained soils and some permanent

ponds. Included areas make up about 10 percent of the total acreage.

The soils in this unit are mottled, calcareous loamy sand to clay loam 60 inches thick or more. They are mildly alkaline to moderately alkaline.

Permeability and available water capacity are variable. Effective rooting depth is limited by a seasonal high water table that is at a depth of 0 to 10 inches in spring and early in summer and at a depth of 10 to 40 inches during the rest of the year. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is slight. These soils are subject to flooding during prolonged, high intensity storms. Channeling and deposition are common along streambanks.

This unit is used as rangeland and for wildlife habitat.

The potential plant community on the Haplaquolls is mainly switchgrass, prairie cordgrass, big bluestem, indiangrass, western wheatgrass, slender wheatgrass, and sedges. The average annual production of air-dry vegetation ranges from 2,000 to 4,000 pounds. The potential plant community on the Fluvaquents is mainly alkali sacaton, switchgrass, and western wheatgrass. the average annual production of air-dry vegetation ranges from 1,000 to 3,000 pounds.

Grazing should be delayed until the soils have drained sufficiently and are firm enough to withstand trampling by livestock. Management practices suitable for use on this unit are proper range use, deferred grazing, and rotation grazing.

This unit is poorly suited to windbreaks and environmental plantings. The main limitations are the seasonal high water table and periodic flooding.

This map unit is in capability subclass VIw, nonirrigated. The Haplaquolls are in Wet Meadow range site, and the Fluvaquents are in Salt Meadow range site.

29—Haverson loam, 0 to 3 percent slopes. This deep, well drained soil is on flood plains and adjacent stream terraces. It formed in stratified, calcareous, loamy alluvium.

Typically, the surface layer is pale brown and light brownish gray loam 12 inches thick. The underlying material to a depth of 60 inches or more is very fine sandy loam and loam stratified with thin lenses of sand, loamy sand, and clay loam. The soil is calcareous throughout.

Included in this unit are small areas of Nunn loam and Nunn clay loam.

Permeability of this Haverson soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of water erosion is slight. The hazard of soil blowing is moderate. This soil is subject to brief periods of flooding in spring and summer.

Most areas of this unit are used as rangeland. A few areas are used as nonirrigated cropland. Winter wheat is the main crop.

The potential plant community on this unit is mainly western wheatgrass, fourwing saltbush, switchgrass, green needlegrass, and blue grama. The average annual production of air-dry vegetation ranges from 1,000 to 3,500 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community. Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is suited to winter wheat, barley, oats, and sorghum. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Precipitation usually is too low for crops on this unit to make efficient use of fertilizer.

Maintaining crop residue on or near the surface reduces soil blowing and helps to maintain soil tilth and organic matter content. Stubble-mulch farming, stripcropping, and minimum tillage help to control erosion and conserve moisture. Terraces reduce runoff and the risk of erosion and help to conserve moisture.

This unit is well suited to windbreaks and environmental plantings. It is limited mainly by brief periods of flooding. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass IVe, nonirrigated, and in Overflow range site.

30—Keith loam, 0 to 6 percent slopes. This deep, well drained soil is on slightly dissected plains, in swales, and on stream terraces. It formed in calcareous loamy alluvium.

Typically, the surface layer is grayish brown loam 4 inches thick. The subsoil is silt loam 16 inches thick. The substratum to a depth of 60 inches or more is silt loam.

Included in this unit are small areas of Mitchell silt loam, Kim loam, Wages fine sandy loam, and Weld loam.

Permeability of this Keith soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight to moderate. The hazard of soil blowing is slight.

Most areas of this unit are used as rangeland. A few areas are used as nonirrigated cropland. Winter wheat is the main crop.

The potential plant community on this unit is mainly blue grama, western wheatgrass, sedges, and buffalograss. The average annual production of air-dry vegetation ranges from 500 to 1,500 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to winter wheat, barley, oats, and sorghum. Low annual precipitation is the main limitation for the crops that can be grown on this unit. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Precipitation usually is too low for crops on this unit to make efficient use of fertilizer.

Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Stubble-mulch farming, stripcropping, and minimum tillage help to control erosion and conserve moisture. Terraces reduce runoff and the risk of erosion and help to conserve moisture.

This unit is well suited to windbreaks and environmental plantings. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass IVe, nonirrigated, and in Loamy Plains range site.

31—Kim-Mitchell complex, 0 to 6 percent slopes. This map unit is on smooth to slightly dissected plains and alluvial fans.

This unit is about 45 percent Kim loam and 40 percent Mitchell silt loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Haverson, Thedalund, and Keota loams. Included areas make up 15 percent of the total acreage. The percentage varies from one area to another.

The Kim soil is deep and well drained. It formed in calcareous loamy alluvium. Typically, the surface layer is light brownish gray loam 3 inches thick. The subsurface layer is light brownish gray clay loam 4 inches thick. The underlying material to a depth of 60 inches or more is light gray loam. The soil is calcareous throughout.

Permeability of the Kim soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of water erosion is slight to moderate. The hazard of soil blowing is moderate.

The Mitchell soil is deep and well drained. It formed in calcareous loamy alluvium. Typically, the surface layer is brown and pale brown silt loam 7 inches thick. The subsurface layer is silt loam 5 inches thick. The underlying material to a depth of 60 inches or more is silt loam. The soil is calcareous throughout.

Permeability of the Mitchell soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of water erosion is slight to moderate. The hazard of soil blowing is moderate.

Most areas of this unit are used as rangeland. A few areas are used as nonirrigated cropland. Winter wheat is the main crop.

The potential plant community on the Kim soil is mainly blue grama, western wheatgrass, sedges, and buffalograss. The average annual production of air-dry vegetation ranges from 500 to 1,500 pounds. The potential plant community on the Mitchell soil is mainly blue grama, western wheatgrass, and fourwing saltbush. The average annual production of air-dry vegetation ranges from 500 to 1,600 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce plants suitable for grazing.

This unit is suited to winter wheat, barley, oats, and sorghum. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Precipitation usually is too low for crops on this unit to make efficient use of fertilizer.

Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Stubble-mulch farming, stripcropping, and minimum tillage help to control erosion and conserve moisture. Terraces reduce runoff and the risk of erosion and help to conserve moisture.

This unit is well suited to windbreaks and environmental plantings. It is limited mainly by the hazard of soil blowing where the surface layer is barren of vegetation. Only small areas or strips should be cleared for tree planting. Soil blowing can be reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass IVe, nonirrigated. The Kim soil is in Loamy Plains range site, and the Mitchell soil is in Siltstone Plains range site.

32—Kim-Mitchell complex, 6 to 9 percent slopes. This map unit is on moderately dissected to highly dissected plains and alluvial and colluvial fans.

This unit is about 45 percent Kim loam and 35 percent Mitchell silt loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Haverson loam, Thedalund loam, Keota loam, and soils that have slopes of less than 6 percent. Included areas make up 20 percent of the total acreage. The percentage varies from one area to another.

The Kim soil is deep and well drained. It formed in calcareous loamy alluvium and colluvium. Typically, the surface layer is light brownish gray loam 3 inches thick. The subsurface layer is light brownish gray clay loam 4 inches thick. The underlying material to a depth of 60 inches or more is light gray loam. The soil is calcareous throughout.

Permeability of the Kim soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

The Mitchell soil is deep and well drained. It formed in calcareous loamy alluvium and colluvium. Typically, the surface layer is brown silt loam 7 inches thick. The subsurface layer is very pale brown silt loam 5 inches thick. The underlying material to a depth of 60 inches or more is very pale brown silt loam. The soil is calcareous throughout.

Permeability of the Mitchell soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

This unit is used as rangeland.

The potential plant community on the Kim soil is mainly blue grama, western wheatgrass, sedges, and buffalograss. The average annual production of air-dry vegetation ranges from 400 to 1,300 pounds. The potential plant community on the Mitchell soil is mainly blue grama, western wheatgrass, and fourwing saltbush. The average annual production of air-dry vegetation ranges from 400 to 1,500 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. It is limited mainly by the hazard of soil blowing where the surface layer is barren of vegetation. Only small areas or strips should be cleared for tree planting. Soil blowing can be reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass VIe, nonirrigated. The Kim soil is in Loamy Plains range site, and the Mitchell soil is in Siltstone Plains range site.

33—Kim-Shingle complex, 6 to 30 percent slopes. This map unit is on plains, breaks, and alluvial and colluvial fans.

This unit is about 60 percent Kim loam and 20 percent Shingle clay loam. The Kim soil is on moderately dissected to highly dissected plains, alluvial fans, and colluvial fans. The Shingle soil is on moderately dissected to highly dissected breaks. The individual components of this unit are in areas so narrow that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Cascajo soils. Also included are small areas of Rock outcrop and soils that are moderately deep to shale. Included areas make up about 20 percent of the total acreage. The percentage varies from one area to another.

The Kim soil is deep and well drained. It formed in calcareous loamy alluvium and colluvium. Typically, the surface layer is light brownish gray loam 3 inches thick. The subsurface layer is clay loam 4 inches thick. The underlying material to a depth of 60 inches or more is loam. The soil is calcareous throughout.

Permeability of the Kim soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of water erosion is high to very high. The hazard of soil blowing is moderate.

The Shingle soil is shallow and well drained. It formed in calcareous loamy or clayey residuum derived from shale. Typically, the surface layer is yellowish brown clay loam 4 inches thick. The underlying material is clay loam 7 inches thick. Shale is at a depth of 11 inches. Depth to shale ranges from 10 to 20 inches. The soil is calcareous throughout.

Permeability of the Shingle soil is moderate. Available water capacity is low. Effective rooting depth is 10 to 20 inches. Runoff is medium to rapid, and the hazard of water erosion is high to very high. The hazard of soil blowing is slight.

This unit is used as rangeland.

The potential plant community on the Kim soil is mainly blue grama, western wheatgrass, and sedges. The average annual production of air-dry vegetation ranges from 500 to 1,500 pounds. The potential plant community on the Shingle soil is mainly western wheatgrass, blue grama, alkali sacaton, and sideoats grama. The average annual production of air-dry vegetation ranges from 300 to 900 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

The Kim soil is well suited to windbreaks and environmental plantings. The Shingle soil is poorly suited to windbreaks and environmental plantings. It is limited mainly by shallow rooting depth and low available water capacity. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass VIe, nonirrigated. The Kim soil is in Loamy Plains range site, and the Shingle soil is in Shaly Plains range site.

34—Manter sandy loam, 0 to 6 percent slopes. This deep, well drained soil is on slightly dissected to moderately dissected plains. It formed in calcareous loamy alluvium.

Typically, the surface layer is brown sandy loam 3 inches thick. The upper 13 inches of the subsoil is sandy loam, and the lower 5 inches is calcareous sandy loam. The upper 7 inches of the substratum is calcareous sandy loam, and the lower part to a depth of 60 inches or more is calcareous loamy sand. In some areas the surface layer is loamy sand.

Included in this unit are soils that are similar to this Manter soil but do not have lime at a depth of less than 40 inches. Included areas make up about 10 percent of the total acreage.

Permeability of this Manter soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight to moderate. The hazard of soil blowing is moderate.

This unit is used mainly as nonirrigated cropland. Winter wheat is the main crop. The unit is also used as rangeland.

This unit is suited to winter wheat, barley, oats, and sorghum. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Precipitation usually is too low for crops on this unit to make efficient use of fertilizer.

Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Stubble-mulch farming, stripcropping, and minimum tillage help to control erosion and conserve moisture. Terraces reduce runoff and the risk of erosion and help to conserve moisture.

The potential plant community on this unit is mainly blue grama, needleandthread, and prairie sandreed. The average annual production of air-dry vegetation ranges from 800 to 2,000 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. It is limited mainly by the hazard of soil blowing where the soil is barren of vegetation. Supplemental irrigation may be needed when planting and during dry periods. Summer fallow, cultivation for weed control, and selection of adapted plants are needed to insure establishment and survival of seedlings.

This map unit is in capability subclass IVe, nonirrigated, and in Sandy Plains range site.

35—Manter sandy loam, 6 to 9 percent slopes. This deep, well drained soil is on moderately dissected to highly dissected plains. It formed in calcareous loamy alluvium.

Typically, the surface layer is brown sandy loam 3 inches thick. The upper 13 inches of the subsoil is sandy loam, and the lower 5 inches is calcareous sandy loam. The upper 7 inches of the substratum is calcareous sandy loam, and the lower part to a depth of 60 inches or more is calcareous loamy sand. In some areas the surface layer is loamy sand.

Included in this unit are small areas of soils that are similar to this Manter soil but have slopes of less than 6 percent or do not have lime at a depth of less than 40

inches. Included areas make up about 10 percent of the total acreage.

Permeability of this Manter soil is moderately rapid to a depth of 28 inches and rapid below this depth. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

This unit is used as rangeland.

The potential plant community on this unit is mainly blue grama, needleandthread, prairie sandreed, and sand dropseed. The average annual production of air-dry vegetation ranges from 700 to 1,800 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. It is limited mainly by the hazard of soil blowing where the soil is barren of vegetation. Supplemental irrigation may be needed when planting and during dry periods. Summer fallow, cultivation for weed control, and selection of adapted plants are needed to insure establishment and survival of seedlings.

This map unit is in capability subclass VIe, nonirrigated, and in Sandy Plains range site.

36—Manzanola clay loam, 0 to 3 percent slopes. This deep, well drained soil is on plains, in swales, and on adjacent stream terraces. It formed in calcareous clayey alluvium. Slopes are plane or concave.

Typically, the surface layer is grayish brown heavy clay loam 3 inches thick. The subsoil is calcareous clay 22 inches thick. The substratum to a depth of 60 inches or more is calcareous clay and clay loam.

Included in this unit are small areas of Avar fine sandy loam and soils that have a sodium content of more than 15 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Manzanola soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium to slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

Most areas of this unit are used as rangeland. A few areas are used as nonirrigated cropland. Winter wheat is the main crop.

The potential plant community on this unit is mainly blue grama, western wheatgrass, and fourwing saltbush. The average annual production of air-dry vegetation ranges from 500 to 1,200 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Livestock grazing should be managed to protect the soil in this unit from erosion.

This unit is suited to winter wheat, barley, oats, and sorghum. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Precipitation usually is too low for crops on this unit to make efficient use of fertilizer.

Maintaining crop residue on or near the surface reduces soil blowing and helps to maintain soil tilth and organic matter content. Stubble-mulch farming, stripcropping, and minimum tillage help to control erosion and conserve moisture. Terraces reduce runoff and the risk of erosion and help to conserve moisture.

This unit is well suited to windbreaks and environmental plantings. It has few limitations. Supplemental irrigation may be needed when planting and during dry periods. Summer fallow, cultivation for weed control, and selection of adapted plants are needed to insure establishment and survival of seedlings.

This map unit is in capability subclass IVe, nonirrigated, and in Clayey Plains range site.

37—Midway clay loam, 0 to 9 percent slopes. This shallow, well drained soil is on slightly dissected to highly dissected plains, breaks, and upland ridges. It formed in calcareous clayey residuum derived from shale.

Typically, the surface layer is grayish brown clay loam 3 inches thick. Below this is calcareous clay 8 inches thick. Shale is at a depth of 11 inches. Depth to shale ranges from 10 to 20 inches.

Included in this unit are small areas of Renohill fine sandy loam, Rock outcrop of shale, and areas of soils that are ponded intermittently. Included areas make up about 20 percent of the total acreage.

Permeability of this Midway soil is slow. Available water capacity is low. Effective rooting depth is 10 to 20 inches. Runoff is medium to rapid, and the hazard of water erosion is slight to very high. The hazard of soil blowing is moderate.

This unit is used as rangeland.

The potential plant community on this unit is mainly blue grama, western wheatgrass, alkali sacaton, and sideoats grama. The average annual production of air-dry vegetation ranges from 300 to 900 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is poorly suited to windbreaks and environmental plantings. The main limitation is the shallow rooting depth.

This map unit is in capability subclass VIIe, nonirrigated, and in Shaly Plains range site.

38—Nucla loam, 0 to 3 percent slopes. This deep, well drained soil is on slightly dissected plains. It formed in calcareous loamy alluvium.

Typically, the surface layer is brown loam 4 inches thick. The subsoil is clay loam 10 inches thick. The substratum to a depth of 60 inches or more is clay loam.

Included in this unit are small areas of Ascalon fine sandy loam, Bushman fine sandy loam, and Nunn loam. Included areas make up about 15 percent of the total acreage.

Permeability of this Nucla soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This unit is used as rangeland and nonirrigated cropland. Winter wheat is the main crop.

The potential plant community on this unit is mainly blue grama, western wheatgrass, sedges, and buffalograss. The average annual production of air-dry vegetation ranges from 500 to 1,500 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

Management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from soil blowing is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to winter wheat, barley, oats, and sorghum. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Precipitation usually is too low for crops on this unit to make efficient use of fertilizer.

Maintaining crop residue on or near the surface reduces soil blowing and helps to maintain soil tilth and organic matter content. Stubble-mulch farming, stripcropping, and minimum tillage help to control erosion and conserve moisture. Terraces reduce runoff and the risk of erosion and help to conserve moisture.

This unit is well suited to windbreaks and environmental plantings. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass IVe, nonirrigated, and in Loamy Plains range site.

39—Nucla loam, 3 to 9 percent slopes. This deep, well drained soil is on moderately dissected plains. It formed in calcareous loamy alluvium.

Typically, the surface layer is brown loam 4 inches thick. The subsoil is clay loam 10 inches thick. The substratum to a depth of 60 inches or more is clay loam.

Included in this unit are small areas of Ascalon fine sandy loam, Bushman fine sandy loam, and Nunn loam. Included areas make up about 15 percent of the total acreage.

Permeability of this Nucla soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate to high. The hazard of soil blowing is moderate.

This unit is used as rangeland.

The potential plant community on this unit is mainly blue grama, western wheatgrass, sedges, and buffalograss. The average annual production of air-dry vegetation ranges from 400 to 1,300 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil in this unit to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass VIe, nonirrigated, and in Loamy Plains range site.

40—Nunn loam, 0 to 6 percent slopes. This deep, well drained soil is on slightly dissected plains and stream terraces. It formed in calcareous loamy alluvium.

Typically, the surface layer is grayish brown loam 7 inches thick. The subsoil is clay loam 25 inches thick. The substratum to a depth of 60 inches or more is calcareous clay loam. In some areas the surface layer is clay loam.

Included in this unit are small areas of Avar fine sandy loam and Manzanola clay loam.

Permeability of this Nunn soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight to moderate. The hazard of soil blowing is slight.

This unit is used as nonirrigated cropland and rangeland. Winter wheat is the main crop.

This unit is suited to winter wheat, barley, oats, and sorghum. Low annual precipitation is the main limitation. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Precipitation usually is too low for crops on this unit to make efficient use of fertilizer.

Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Stubble-mulch farming, stripcropping, and minimum tillage help to control erosion and conserve moisture. Terraces reduce runoff and the risk of erosion and help to conserve moisture.

The potential plant community on this unit is mainly blue grama, western wheatgrass, sedges, and buffalograss. The average annual production of air-dry vegetation ranges from 500 to 1,500 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass IVe, nonirrigated, and in Loamy Plains range site.

41—Nunn clay loam, 0 to 6 percent slopes. This deep, well drained soil is on slightly dissected plains and stream terraces. It formed in calcareous loamy alluvium.

Typically, the surface layer is grayish brown clay loam 8 inches thick. The subsoil is clay loam 14 inches thick. The substratum to a depth of 60 inches or more is calcareous clay loam. In some areas the surface layer is loam.

Included in this unit are small areas of Avar fine sandy loam and Manzanola clay loam.

Permeability of this Nunn soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight to moderate. The hazard of soil blowing is slight.

This unit is used as rangeland and nonirrigated cropland. Winter wheat is the main crop.

The potential plant community on this unit is mainly blue grama, western wheatgrass, green needlegrass, and buffalograss. The average annual production of air-dry vegetation ranges from 400 to 1,200 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to winter wheat, barley, oats, and sorghum. The fine texture of the surface layer limits the crops that can be grown on this unit. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Precipitation usually is too low for crops on this unit to make efficient use of fertilizer.

Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Stubble-mulch farming, stripcropping, and minimum tillage help to control erosion and conserve moisture. Terraces reduce runoff and the risk of erosion and help to conserve moisture.

This unit is well suited to windbreaks and environmental plantings. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass IVe, nonirrigated, and in Clayey Plains range site.

42—Olney loamy sand, 0 to 3 percent slopes. This deep, well drained soil is on smooth to slightly dissected plains. It formed in calcareous loamy alluvium.

Typically, the surface layer is pale brown loamy sand 5 inches thick. The subsoil is sandy clay loam 29 inches thick. The substratum to a depth of 60 inches or more is calcareous sandy loam.

Included in this unit are small areas of Olney fine sandy loam, Ascalon fine sandy loam, and Stoneham fine sandy loam.

Permeability of this Olney soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight. The hazard of soil blowing is high.

Most areas of this unit are used as nonirrigated cropland. Winter wheat is the main crop. A few areas are used as rangeland.

This unit is suited to winter wheat, barley, oats, and sorghum. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Precipitation usually is too low for crops on this unit to make efficient use of fertilizer.

Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Stubble-mulch farming, stripcropping, and minimum tillage help to control erosion and conserve moisture. Terraces reduce runoff and the risk of erosion and help to conserve moisture.

The potential plant community on this unit is mainly blue grama, prairie sandreed, and needleandthread. The average annual production of air-dry vegetation ranges from 800 to 2,000 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from soil blowing is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. Soil blowing can be reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass IVe, nonirrigated, and in Sandy Plains range site.

43—Olney loamy sand, 3 to 9 percent slopes. This deep, well drained soil is on moderately dissected to highly dissected plains. It formed in calcareous loamy alluvium.

Typically, the surface layer is pale brown loamy sand 4 inches thick. The subsoil is sandy clay loam 27 inches thick. The substratum to a depth of 60 inches or more is calcareous sandy loam.

Included in this unit are small areas of Olney fine sandy loam, Ascalon fine sandy loam, and Stoneham fine sandy loam.

Permeability of this Olney soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

This unit is used as rangeland.

The potential plant community on this unit is mainly blue grama, prairie sandreed, and needleandthread. The average annual production of air-dry vegetation ranges from 700 to 1,800 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. Soil blowing can be reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass VIe, nonirrigated, and in Sandy Plains range site.

44—Olney fine sandy loam, 0 to 6 percent slopes. This deep, well drained soil is on smooth to moderately dissected plains. It formed in calcareous loamy alluvium.

Typically, the surface layer is brown fine sandy loam 6 inches thick. The upper 12 inches of the subsoil is sandy clay loam or loam, and the lower 10 inches is calcareous sandy loam. The substratum to a depth of 60 inches or more is calcareous sandy loam.

Included in this unit are small areas of Olney loamy sand, Ascalon fine sandy loam, and Stoneham fine sandy loam.

Permeability of this Olney soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of water erosion is slight to moderate. The hazard of soil blowing is slight.

Most areas of this unit are used as nonirrigated cropland. Winter wheat is the main crop. A few areas are used as rangeland.

This unit is suited to winter wheat, barley, oats, and sorghum. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Precipitation usually is too low for crops on this unit to make efficient use of fertilizer.

Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Stubble-mulch farming, stripcropping, and minimum tillage help to control erosion and conserve moisture. Terraces reduce runoff and the risk of erosion and help to conserve moisture.

The potential plant community on this unit is mainly blue grama, western wheatgrass, sedges, and buffalograss. The average annual production of air-dry vegetation ranges from 500 to 1,500 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. It is limited mainly by the hazard of soil blowing where the surface layer is barren of vegetation. Soil blowing can be reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods. Summer fallow, cultivation for weed control, and selection of adapted plants are needed to insure establishment and survival of seedlings.

This map unit is in capability subclass IVe, nonirrigated, and in Loamy Plains range site.

45—Olney fine sandy loam, 6 to 9 percent slopes. This deep, well drained soil is on moderately dissected to highly dissected plains. It formed in calcareous loamy alluvium.

Typically, the surface layer is brown fine sandy loam 6 inches thick. The upper 12 inches of the subsoil is sandy clay loam or loam, and the lower 10 inches is calcareous sandy loam. The substratum to a depth of 60 inches or more is calcareous sandy loam.

Included in this unit are small areas of Olney loamy sand, Ascalon fine sandy loam, Stoneham fine sandy loam, and Vona sandy loam.

Permeability of this Olney soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate to high. The hazard of soil blowing is moderate.

This unit is used as rangeland.

The potential plant community on this unit is mainly blue grama, western wheatgrass, sedges, and buffalograss. The average annual production of air-dry vegetation ranges from 400 to 1,300 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. It is limited mainly by the hazard of soil blowing where the surface is barren of vegetation. Soil blowing can be reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods. Summer fallow, cultivation for weed control, and selection of adapted plants are needed to insure establishment and survival of seedlings.

This map unit is in capability subclass VIe, nonirrigated, and in Loamy Plains range site.

46—Otero sandy loam, 0 to 3 percent slopes. This deep, well drained soil is on smooth to moderately dissected plains and alluvial fans. It formed in calcareous loamy alluvium.

Typically, the surface layer is brown sandy loam 5 inches thick. The underlying material to a depth of 60 inches or more is sandy loam. The soil is calcareous throughout.

Included in this unit are small areas of Stoneham fine sandy loam, soils that have a gravelly surface layer or gravelly underlying material, Kim and Mitchell soils, and Bushman fine sandy loam. Included areas make up about 20 percent of the total acreage.

Permeability of this Otero soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the

hazard of water erosion is slight. The hazard of soil blowing is moderate.

Most areas of this unit are used as rangeland. A few areas are used as nonirrigated cropland. Winter wheat is the main crop.

The potential plant community on this unit is mainly blue grama, prairie sandreed, and needleandthread. The average annual production of air-dry vegetation ranges from 800 to 2,000 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from soil blowing is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is suited to winter wheat, barley, oats, and sorghum. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Precipitation usually is too low for crops on this unit to make efficient use of fertilizer.

Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Stubble-mulch farming, stripcropping, and minimum tillage help to control erosion and conserve moisture. Terraces reduce runoff and the risk of erosion and help to conserve moisture.

This unit is well suited to windbreaks and environmental plantings. It is limited mainly by the hazard of soil blowing where the surface layer is barren of vegetation. Soil blowing can be reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass IVe, nonirrigated, and in Sandy Plains range site.

47—Otero sandy loam, 3 to 9 percent slopes. This deep, well drained soil is on moderately dissected to highly dissected plains and fans. It formed in calcareous loamy alluvium and colluvium.

Typically, the surface layer is brown sandy loam 5 inches thick. The underlying material to a depth of 60 inches or more is sandy loam. The soil is calcareous throughout.

Included in this unit are small areas of Stoneham fine sandy loam, soils that have a gravelly surface layer or gravelly underlying material, Kim and Mitchell soils, Bushman fine sandy loam, and soils that have slopes of less than 3 percent. Included areas make up about 20 percent of the total acreage.

Permeability of this Otero soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate to high. The hazard of soil blowing is moderate.

This unit is used as rangeland.

The potential plant community on this unit is mainly blue grama, prairie sandreed, and needleandthread. The average annual production of air-dry vegetation ranges from 700 to 1,800 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. It is limited mainly by the hazard of soil blowing where the surface layer is barren of vegetation. Soil blowing can be reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass VIe, nonirrigated, and in Sandy Plains range site.

48—Otero-Tassel complex, 6 to 30 percent slopes. This map unit is on highly dissected, convex shoulders and slightly dissected to highly dissected, concave backslopes and foot slopes of breaks.

This unit is about 50 percent Otero sandy loam and about 25 percent Tassel loamy fine sand. The Otero soil is on the backslopes and foot slopes, and the Tassel soil is on the shoulders. The individual components of this unit are in areas so narrow that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Kim loam in drainageways between foot slopes; Rock outcrop on shoulders; and soils, on backslopes, that are moderately deep to calcareous sandstone. Included areas make up 25 percent of the total acreage.

The Otero soil is deep and well drained. It formed in calcareous loamy alluvium. Typically, the surface layer is brown sandy loam 5 inches thick. The underlying

material to a depth of 60 inches or more is sandy loam. The soil is calcareous throughout.

Permeability of the Otero soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is high to very high. The hazard of soil blowing is moderate.

The Tassel soil is shallow and well drained. It formed in calcareous loamy residuum derived dominantly from sandstone. Typically, the surface layer is light yellowish brown loamy fine sand 7 inches thick. The underlying material is fine sandy loam 12 inches thick. Sandstone is at a depth of 19 inches. Depth to sandstone ranges from 10 to 20 inches. The soil is calcareous throughout.

Permeability of the Tassel soil is moderately rapid. Available water capacity is low. Effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is high to very high. The hazard of soil blowing is moderate.

This unit is used as rangeland.

The potential plant community on the Otero soil is mainly blue grama, prairie sandreed, and needleandthread. The average annual production of air-dry vegetation ranges from 700 to 2,000 pounds. The potential plant community on the Tassel soil is mainly blue grama, sideoats grama, little bluestem, and threadleaf sedge. The average annual production of air-dry vegetation ranges from 300 to 1,000 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Areas that are heavily infested with undesirable plants can be improved by proper grazing management. management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce plants suitable for grazing. Slope limits access by livestock and results in overgrazing of the less sloping areas.

The Otero soil is well suited to windbreaks and environmental plantings. It is limited mainly by the hazard of soil blowing where the surface layer is barren of vegetation. Soil blowing can be reduced by cultivating only in the tree rows and by leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods.

The Tassel soil is poorly suited to windbreaks and environmental plantings. The main limitations are shallow rooting depth, low available water capacity, and steepness of slopes.

This map unit is in capability subclass VIe, nonirrigated. The Otero soil is in Sandy Plains range site, and the Tassel soil is in Sandstone Breaks range site.

49—Paoli fine sandy loam, 0 to 6 percent slopes. This deep, well drained soil is on slightly dissected to moderately dissected alluvial fans. It formed in calcareous loamy alluvium. Slopes are concave.

Typically, the upper 15 inches of the surface layer is brown fine sandy loam and the lower 12 inches is brown coarse sandy loam. The underlying material to a depth of 60 inches or more is coarse sandy loam and sandy loam. The soil is calcareous below a depth of 8 inches.

Included in this unit are small areas of soils that have a surface layer of loamy sand, soils that are noncalcareous, and soils that have restricted drainage. Included areas make up about 15 percent of the total acreage.

Permeability of this Paoli soil is moderately rapid to a depth of 15 inches and rapid below this depth. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow to very slow, and the hazard of water erosion is slight to moderate. The hazard of soil blowing is moderate.

Most areas of this unit are used as rangeland. A few areas are used as nonirrigated cropland. Winter wheat is the main crop.

The potential plant community on this unit is mainly blue grama, needleandthread, and prairie sandreed. The average annual production of air-dry vegetation ranges from 800 to 2,000 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Livestock grazing should be managed to protect the soil in this unit from erosion.

This unit is suited to winter wheat, barley, oats, and sorghum. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Precipitation usually is too low for crops on this unit to make efficient use of fertilizer.

Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Stubble-mulch farming, stripcropping, and minimum tillage help to control erosion and conserve moisture. Terraces reduce runoff and the risk of erosion and help to conserve moisture.

If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. It has few limitations.

Supplemental irrigation may be needed when planting and during dry periods. Summer fallow, cultivation for weed control, and selection of adapted plants are needed to insure establishment and survival of seedlings.

This map unit is in capability subclass IVe, nonirrigated, and in Sandy Plains range site.

50—Paoli fine sandy loam, 6 to 9 percent slopes. This deep, well drained soil is on moderately dissected to highly dissected fans. It formed in calcareous loamy alluvium and colluvium. Slopes are concave.

Typically, the surface layer is brown fine sandy loam 13 inches thick. It is calcareous in the lower part. The underlying material to a depth of 60 inches or more is calcareous sandy loam or coarse sandy loam.

Included in this unit are small areas of soils that have a surface layer of loamy sand, soils that are noncalcareous, soils that have restricted drainage, and soils that have slopes of less than 6 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Paoli soil is moderately rapid to a depth of 13 inches and rapid below this depth. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

This unit is used as rangeland.

The potential plant community on this unit is mainly blue grama, needleandthread, and prairie sandreed. The average annual production of air-dry vegetation ranges from 700 to 1,800 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. It has few limitations. Supplemental irrigation may be needed when planting and during dry periods. Summer fallow, cultivation for weed control, and selection of adapted plants are needed to insure establishment and survival of seedlings.

This map unit is in capability subclass VIe, nonirrigated, and in Sandy Plains range site.

51—Peetz gravelly sandy loam, 5 to 20 percent slopes. This deep, somewhat excessively drained soil is on backslopes and shoulders of moderately dissected to highly dissected upland ridges and breaks. It formed in calcareous gravelly alluvium. Slopes are convex. Areas are nearly linear in shape and are 20 to 1,000 acres in size.

Typically, 15 to 35 percent of the surface is covered with gravel and cobbles. Typically, the upper part of the surface layer is grayish brown gravelly sandy loam 4 inches thick, and the lower part is brown very gravelly loamy sand 4 inches thick. The underlying material to a depth of 60 inches or more is calcareous very gravelly sand.

Included in this unit are small areas of Altvan sandy loam on the tops of upland ridges and breaks; Rock outcrop on shoulders of upland ridges and breaks; Bushman fine sandy loam on backslopes and foot slopes of upland ridges and breaks; and Ascalon fine sandy loam and Wages fine sandy loam on foot slopes of upland ridges and breaks. Included areas make up about 20 percent of the total acreage.

Permeability of this Peetz soil is rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is high to very high. The hazard of soil blowing is slight.

Most areas of this unit are used as rangeland. A few areas are used as a source of gravel.

The potential plant community on this unit is mainly blue grama, little bluestem, sideoats grama, and prairie sandreed. The average annual production of air-dry vegetation ranges from 500 to 1,200 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Livestock grazing should be managed to protect the soil in this unit from erosion. Slope limits access by livestock and results in overgrazing of the less sloping areas. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is poorly suited to windbreaks and environmental plantings. The main limitations are the high content of lime and the moderate available water capacity. Supplemental irrigation may be needed when planting and during dry periods. Summer fallow, cultivation for weed control, and selection of adapted plants are needed to insure establishment and survival of seedlings.

This map unit is in capability subclass VIe, nonirrigated, and in Gravel Breaks range site.

52—Peetz-Altvan complex, 0 to 20 percent slopes. This map unit is on upland ridges, breaks, and plains.

This unit is about 40 percent Peetz gravelly sandy loam and about 35 percent Altvan fine sandy loam. The Peetz soil is on shoulders of upland ridges and breaks. The Altvan soil is on upland ridgetops and on moderately dissected to highly dissected plains and high plains. The individual components of this unit are in areas so narrow that it was not practical to map them separately at the scales used.

Included in this unit is about 25 percent Bushman fine sandy loam, Paoli fine sandy loam, and Otero sandy loam.

The Peetz soil is deep and somewhat excessively drained. It formed in calcareous gravelly alluvium. Typically, 15 to 35 percent of the surface is covered with gravel, cobbles, and small stones. The upper part of the surface layer is grayish brown gravelly sandy loam 4 inches thick, and the lower part is brown very gravelly loamy sand 4 inches thick. The underlying material to a depth of 60 inches or more is calcareous very gravelly sand.

Permeability of the Peetz soil is rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight to moderate. The hazard of soil blowing is slight to very high.

The Altvan soil is deep and well drained. It formed in calcareous gravelly alluvium. Typically, the surface layer is dark grayish brown fine sandy loam 3 inches thick. The subsoil is sandy clay loam and clay loam 16 inches thick. The substratum to a depth of 60 inches or more is gravelly coarse sand. In some areas the surface layer is loam.

Permeability of the Altvan soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is slight to very high. The hazard of soil blowing is moderate.

Most areas of this unit are used as rangeland. A few areas are used as a source of gravel.

The potential plant community on the Peetz soil is mainly blue grama, little bluestem, sideoats grama, and prairie sandreed. The average annual production of air-dry vegetation ranges from 600 to 1,200 pounds. The potential plant community on the Altvan soil is mainly blue grama, needleandthread, western wheatgrass, and prairie sandreed. The average annual production of air-dry vegetation ranges from 500 to 1,500 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Mechanical treatment is not practical because of the stony surface and the steepness of slope. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce plants suitable for grazing. Slope limits access by livestock and results in overgrazing of the less sloping areas.

The Peetz soil is poorly suited to windbreaks and environmental plantings. The main limitations are the high content of lime, low available water capacity, and steepness of slope.

The Altvan soil is well suited to windbreaks and environmental plantings. It has few limitations.

This map unit is in capability subclass VIe, nonirrigated. The Peetz soil is in Gravel Breaks range site, and the Altvan soil is in Loamy Plains range site.

53—Peetz-Rock outcrop complex, 9 to 40 percent slopes. This map unit is on shoulders of breaks and escarpments.

This unit is about 40 percent Peetz gravelly sandy loam and about 30 percent Rock outcrop. The individual components of this unit are in areas so narrow that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bushman fine sandy loam, Otero sandy loam, and Paoli fine sandy loam on foot slopes of terrace escarpments; Treon fine sandy loam and Tassel loamy fine sand on the upper part of the backslopes and shoulders of terrace escarpments; Altvan sandy loam on the upper part of the shoulders of terrace escarpments; and soils that are moderately deep to sandstone and are on the lower part of the shoulders of terrace escarpments. Included soils make up 30 percent of the total acreage. The percentage varies from one area to another.

The Peetz soil is deep and somewhat excessively drained. It formed in calcareous gravelly alluvium. Typically, 15 to 35 percent of the surface is covered with gravel and cobbles. The surface layer is grayish brown gravelly sandy loam 4 inches thick. The underlying material to a depth of 60 inches or more is calcareous very gravelly sand.

Permeability of the Peetz soil is rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is very high. The hazard of soil blowing is slight.

Rock outcrop consists mainly of exposed areas of sandstone. These areas form the vertical face of escarpments and the shoulders and backslopes of colluvial fans.

This unit is used as rangeland.

The potential plant community on the Peetz soil is mainly blue grama, little bluestem, sideoats grama, and prairie sandreed. The average annual production of air-dry vegetation ranges from 600 to 1,200 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance

of preferred species is maintained in the plant community.

If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce plants suitable for grazing. Slope limits access by livestock and results in overgrazing of the less sloping areas.

Management practices suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Livestock grazing should be managed to protect the unit from excessive erosion. Mechanical treatment is not practical because of the areas of Rock outcrop and the steepness of slope.

This unit is poorly suited to windbreaks and environmental plantings. The main limitations of the Peetz soil are the high content of lime, moderate available water capacity, and steepness of slope. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass VIIs, nonirrigated, and in Gravel Breaks range site.

54—Platner loam, 0 to 3 percent slopes. This deep, well drained soil is on smooth to slightly dissected plains and adjacent stream terraces. It formed in calcareous loamy alluvium.

Typically, the surface layer is grayish brown loam 4 inches thick. The subsoil is clay, clay loam, and silty clay loam 20 inches thick. The substratum to a depth of 60 inches or more is calcareous fine sandy loam and sandy loam.

Included in this unit are small areas of Ascalon fine sandy loam, Manzanola clay loam, and Nunn clay loam. Also included are soils that have a fine sandy loam or sandy loam surface layer.

Permeability of this Platner soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This unit is used as nonirrigated cropland and rangeland. Winter wheat is the main crop.

This unit is well suited to winter wheat, barley, oats, and sorghum. Low annual precipitation is the main limitation for the crops that can be grown on this unit. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Precipitation usually is too low for crops on this unit to make efficient use of fertilizer.

Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Stubble-mulch farming, stripcropping, and minimum tillage help to control erosion and conserve moisture. Terraces reduce runoff and the risk of erosion and help to conserve moisture.

The potential plant community on this unit is mainly blue grama, western wheatgrass, sedges, and buffalograss. The average annual production of air-dry vegetation ranges from 500 to 1,500 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from soil blowing is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass IV, nonirrigated, and in Loamy Plains range site.

55—Renohill fine sandy loam, 0 to 6 percent slopes. This moderately deep, well drained soil is on slightly dissected to moderately dissected plains. It formed in calcareous loamy or clayey residuum derived dominantly from shale.

Typically, the surface layer is brown fine sandy loam 5 inches thick. The subsoil is clay loam 13 inches thick. The substratum is calcareous clay loam 14 inches thick. Shale is at a depth of 32 inches. Depth to shale ranges from 20 to 40 inches. In some areas the surface layer is loam or clay loam.

Included in this unit are small areas of Midway clay loam, Shingle loam, and Rock outcrop of shale.

Permeability of this Renohill soil is slow. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is slight to moderate. The hazard of soil blowing is moderate.

This unit is used as rangeland and nonirrigated cropland.

The potential plant community on this unit is mainly blue grama, western wheatgrass, sedges, and buffalograss. The average annual production of air-dry vegetation ranges from 500 to 1,500 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for

use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is suited to winter wheat, barley, oats, and sorghum. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Precipitation usually is too low for crops on this unit to make efficient use of fertilizer.

Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Stubble-mulch farming, stripcropping, and minimum tillage help to control erosion and conserve moisture. Terraces reduce runoff and the risk of erosion and help to conserve moisture.

This unit is well suited to windbreaks and environmental plantings. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass IVe, nonirrigated, and in Loamy Plains range site.

56—Renohill fine sandy loam, 6 to 9 percent slopes. This moderately deep, well drained soil is on moderately dissected to highly dissected plains. It formed in calcareous loamy or clayey residuum derived dominantly from shale.

Typically, the surface layer is brown fine sandy loam 4 inches thick. The subsoil is clay loam 13 inches thick. The substratum is calcareous clay loam 12 inches thick. Shale is at a depth of 29 inches. Depth to shale ranges from 20 to 40 inches. In some areas the surface layer is loam.

Included in this unit are small areas of Midway clay loam, Shingle loam, and Rock outcrop of shale.

Permeability of this Renohill soil is slow. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

This unit is used as rangeland.

The potential plant community on this unit is mainly blue grama, western wheatgrass, sedges, and buffalograss. The average annual production of air-dry vegetation ranges from 400 to 1,300 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass VIe, nonirrigated, and in Loamy Plains range site.

57—Renohill-Shingle complex, 3 to 9 percent slopes. This map unit is on moderately dissected to highly dissected plains, upland ridges, and breaks.

This unit is 50 percent Renohill fine sandy loam and 35 percent Shingle clay loam. The Renohill soil is in the less sloping, slightly concave areas, and the Shingle soil is in the steeper, convex areas.

Included in this unit are small areas of Midway and Tassel soils. Also included are some areas of Rock outcrop. Included areas make up 15 percent of the total acreage.

The Renohill soil is moderately deep and well drained. It formed in calcareous loamy or clayey residuum derived dominantly from shale. Typically, the surface layer is brown fine sandy loam 4 inches thick. The subsoil is clay loam 13 inches thick. The substratum is calcareous clay loam 12 inches thick. Shale is at a depth of 29 inches. Depth to shale ranges from 20 to 40 inches.

Permeability of the Renohill soil is slow. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate to high.

The Shingle soil is shallow and well drained. It formed in calcareous loamy or clayey residuum derived dominantly from shale. Typically, the surface layer is yellowish brown clay loam 4 inches thick. The underlying material is clay loam 7 inches thick. Shale is at a depth of 11 inches. Depth to shale ranges from 10 to 20 inches. The soil is calcareous throughout.

Permeability of the Shingle soil is moderate. Available water capacity is low. Effective rooting depth is 10 to 20 inches. Runoff is medium to rapid, and the hazard of water erosion is moderate. The hazard of soil blowing is slight.

This unit is used as rangeland.

The potential plant community on the Renohill soil is mainly blue grama, western wheatgrass, sedges, and buffalograss. The average annual production of air-dry vegetation ranges from 400 to 1,400 pounds. The potential plant community on the Shingle soil is mainly western wheatgrass, blue grama, alkali sacaton, and sideoats grama. The average annual production of air-dry vegetation ranges from 300 to 900 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock

grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soils in this unit to produce plants suitable for grazing.

The Renohill soil is well suited to windbreaks and environmental plantings. The Shingle soil is poorly suited to windbreaks and environmental plantings. The main limitations are shallow rooting depth and low available water capacity.

This map unit is in capability subclass VIe, nonirrigated. The Renohill soil is in Loamy Plains range site, and the Shingle soil is in Shaly Plains range site.

58—Rosebud fine sandy loam, 0 to 6 percent slopes. This moderately deep, well drained soil is on moderately dissected high plains. It formed in calcareous loamy residuum derived dominantly from sandstone.

Typically, the surface layer is dark grayish brown fine sandy loam 5 inches thick. The subsoil is clay loam 14 inches thick. The substratum is sandy clay loam and sandy loam 19 inches thick over limy sandstone. Sandstone is at a depth of 38 inches. Depth to sandstone ranges from 20 to 40 inches.

Included in this unit are small areas of Ascalon fine sandy loam and Platner loam.

Permeability of this Rosebud soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is slight to moderate. The hazard of soil blowing is moderate.

This unit is used as nonirrigated cropland and rangeland. Winter wheat is the main crop.

This unit is well suited to winter wheat, barley, oats, and sorghum. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Precipitation usually is too low for crops on this unit to make efficient use of fertilizer.

Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Stubble-mulch farming, stripcropping, and minimum tillage help to control erosion and conserve moisture. Terraces reduce runoff and the risk of erosion and help to conserve moisture.

The potential plant community on this unit is mainly blue grama, western wheatgrass, sedges, and buffalograss. The average annual production of air-dry vegetation ranges from 600 to 1,600 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass IVe, nonirrigated, and in Loamy Plains range site.

59—Rosebud fine sandy loam, 6 to 9 percent slopes. This moderately deep, well drained soil is on highly dissected high plains. It formed in calcareous loamy residuum derived dominantly from soft sandstone.

Typically, the surface layer is dark grayish brown fine sandy loam 4 inches thick. The subsoil is clay loam 12 inches thick. The substratum is sandy clay loam and sandy loam 12 inches thick. Limy sandstone is at a depth of 28 inches. Depth to sandstone ranges from 20 to 40 inches.

Included in this unit are small areas of Ascalon fine sandy loam. Also included are some areas of Rock outcrop.

Permeability of this Rosebud soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium to rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

This unit is used as rangeland.

The potential plant community on this unit is mainly blue grama, western wheatgrass, sedges, and buffalograss. The average annual production of air-dry vegetation ranges from 500 to 1,400 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results

in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass VIe, nonirrigated, and in Loamy Plains range site.

60—Shingle clay loam, 0 to 9 percent slopes. This shallow, well drained soil is on slightly dissected to moderately dissected plains, upland ridges, and breaks. It formed in calcareous loamy or clayey residuum derived dominantly from shale.

Typically, the surface layer is yellowish brown clay loam 4 inches thick. The underlying material is clay loam 7 inches thick. Shale is at a depth of 11 inches. Depth to shale ranges from 10 to 20 inches. The soil is calcareous throughout.

Included in this unit are small areas of Renohill fine sandy loam, Rock outcrop of shale, areas that are intermittently ponded, Thedalund loam, and Keota loam. Included areas make up about 20 percent of the total acreage.

Permeability of this Shingle soil is moderate. Available water capacity is low. Effective rooting depth is 10 to 20 inches. Runoff is medium to rapid, and the hazard of water erosion is slight to very high. The hazard of soil blowing is slight.

This unit is used as rangeland.

The potential plant community on this unit is mainly western wheatgrass, blue grama, alkali sacaton, and sideoats grama. The average annual production of air-dry vegetation ranges from 300 to 900 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Areas that are heavily infested with undesirable plants can be improved by proper grazing management. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is poorly suited to windbreaks and environmental plantings. The main limitations are shallow rooting depth and low available water capacity.

This map unit is in capability subclass VIe, nonirrigated, and in Shaly Plains range site.

61—Stoneham fine sandy loam, 0 to 6 percent slopes. This deep, well drained soil is on smooth to moderately dissected plains and alluvial fans. It formed in calcareous loamy alluvium.

Typically, the surface layer is pale brown fine sandy loam 5 inches thick. The upper 3 inches of the subsoil is clay loam, and the lower 6 inches is calcareous loam. The substratum to a depth of 60 inches or more is calcareous sandy loam.

Included in this unit are small areas of Kim soils and Mitchell soils. Included areas make up about 15 percent of the total acreage.

Permeability of this Stoneham soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is slight to moderate. The hazard of soil blowing is moderate.

Most areas of this unit are used as rangeland. A few areas are used as nonirrigated cropland. Winter wheat is the main crop.

The potential plant community on this unit is mainly blue grama, western wheatgrass, sedges, and buffalograss. The average annual production of air-dry vegetation ranges from 500 to 1,500 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is suited to winter wheat, barley, oats, and sorghum. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Precipitation usually is too low for crops on this unit to make efficient use of fertilizer.

Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Stubble-mulch farming, stripcropping, and minimum tillage help to control erosion and conserve moisture. Terraces reduce runoff and the risk of erosion and help to conserve moisture.

This unit is well suited to windbreaks and environmental plantings. It has few limitations. Supplemental irrigation may be needed when planting and during dry periods. Summer fallow, cultivation for weed control, and selection of adapted plants are needed to insure establishment and survival of seedlings.

This map unit is in capability subclass IVe, nonirrigated, and in Loamy Plains range site.

62—Stoneham fine sandy loam, 6 to 9 percent slopes. This deep, well drained soil is on moderately dissected to highly dissected plains. It formed in calcareous loamy alluvium.

Typically, the surface layer is pale brown fine sandy loam 5 inches thick. The upper 3 inches of the subsoil is clay loam, and the lower 6 inches is calcareous loam. The substratum to a depth of 60 inches or more is calcareous sandy loam.

Included in this unit are small areas of Kim soils, Mitchell soils, Otero sandy loam, and soils that have slopes of less than 6 percent. Included areas make up about 20 percent of the total acreage.

Permeability of this Stoneham soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is high. The hazard of soil blowing is moderate.

This unit is used as rangeland.

The potential plant community on this unit is mainly blue grama, western wheatgrass, sedges, and buffalograss. The average annual production of air-dry vegetation ranges from 400 to 1,300 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. It has few limitations. Supplemental irrigation may be needed when planting and during dry periods. Summer fallow, cultivation for weed control, and selection of adapted plants are needed to insure establishment and survival of seedlings.

This map unit is in capability subclass VIe, nonirrigated, and in Loamy Plains range site.

63—Tassel loamy fine sand, 5 to 20 percent slopes. This shallow, well drained soil is on moderately dissected to highly dissected plains. It formed in calcareous loamy residuum derived dominantly from sandstone.

Typically, the surface layer is light yellowish brown loamy fine sand 7 inches thick. The underlying material is fine sandy loam 12 inches thick. Sandstone is at a depth of 19 inches. Depth to sandstone ranges from 10 to 20 inches. The soil is calcareous throughout.

Included in this unit are small areas of Shingle loam and noncalcareous soils. Also included are some areas of Rock outcrop.

Permeability of this Tassel soil is moderately rapid. Available water capacity is low. Effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is moderate to very high. The hazard of soil blowing is moderate.

This unit is used as rangeland.

The potential plant community on this unit is mainly blue grama, sideoats grama, little bluestem, and threadleaf sedge. The average annual production of air-dry vegetation ranges from 400 to 1,000 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is poorly suited to windbreaks and environmental plantings. The main limitations are shallow rooting depth, low available water capacity, and steepness of slope.

This map unit is in capability subclass VIe, nonirrigated, and in Sandstone Breaks range site.

64—Terry sandy loam, 0 to 3 percent slopes. This moderately deep, well drained soil is on smooth to moderately dissected plains. It formed in calcareous sandy residuum derived from sandstone.

Typically, the surface layer is grayish brown sandy loam 5 inches thick. The subsoil is sandy loam 12 inches thick. The substratum is calcareous loamy sand 15 inches thick. Sandstone is at a depth of 32 inches. Depth to sandstone ranges from 20 to 40 inches.

Included in this unit are small areas of Olney fine sandy loam, Vona sandy loam, Tassel loamy fine sand, and soils that have a subsoil of sandy clay loam and have sandy shale at a depth of 20 to 40 inches. Included areas make up about 20 percent of the total acreage.

Permeability of this Terry soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

Most areas of this unit are used as rangeland. A few areas are used as nonirrigated cropland. Winter wheat is the main crop.

The potential plant community on this unit is mainly blue grama, prairie sandreed, and needleandthread. The

average annual production of air-dry vegetation ranges from 800 to 2,000 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from soil blowing is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is suited to winter wheat, barley, oats, and sorghum. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Precipitation usually is too low for crops on this unit to make efficient use of fertilizer.

Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Stubble-mulch farming, stripcropping, and minimum tillage help to control erosion and conserve moisture. Terraces reduce runoff and the risk of erosion and help to conserve moisture.

This unit is well suited to windbreaks and environmental plantings. The main limitations are restricted rooting depth and low available water capacity. Supplemental irrigation may be needed when planting and during dry periods. Summer fallow, cultivation for weed control, and selection of adapted plants are needed to insure establishment and survival of seedlings.

This map unit is in capability subclass IVe, nonirrigated, and in Sandy Plains range site.

65—Terry sandy loam, 3 to 9 percent slopes. This moderately deep, well drained soil is on moderately dissected to highly dissected plains. It formed in calcareous sandy residuum derived from sandstone.

Typically, the surface layer is grayish brown sandy loam 5 inches thick. The subsoil is sandy loam 12 inches thick. The substratum is calcareous loamy sand 15 inches thick. Sandstone is at a depth of 32 inches. Depth to sandstone ranges from 20 to 40 inches.

Included in this unit are small areas of Olney fine sandy loam, Vona sandy loam, and Tassel loamy fine sand. Also included are small areas of soils that have a subsoil of sandy clay loam and have sandy shale at a depth of 20 to 40 inches and soils that have slopes of less than 3 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Terry soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is slow, and the hazard of water erosion is moderate to high. The hazard of soil blowing is moderate.

This unit is used as rangeland.

The potential plant community on this unit is mainly blue grama, sand dropseed, prairie sandreed, and needleandthread. The average annual production of air-dry vegetation ranges from 700 to 1,800 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. The main limitations are restricted rooting depth and low available water capacity. Supplemental irrigation may be needed when planting and during dry periods. Summer fallow, cultivation for weed control, and selection of adapted plants are needed to insure establishment and survival of seedlings.

This map unit is in capability subclass VIe, nonirrigated, and in Sandy Plains range site.

66—Thedalund-Keota loams, 0 to 3 percent slopes. This map unit is on moderately dissected alluvial fans, upland ridges, and plains.

This unit is about 45 percent Thedalund loam and about 35 percent Keota loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit is about 20 percent Epping silt loam, Kim loam, Mitchell silt loam, and Shingle clay loam. Also included are some areas of Rock outcrop. Included areas make up about 20 percent of the total acreage.

The Thedalund soil is moderately deep and well drained. It formed in calcareous loamy residuum derived from fine grained sandstone, shale, and siltstone. Typically, the surface layer is grayish brown loam 3 inches thick. Below this is loam 22 inches thick. Sandstone is at a depth of 25 inches. Depth to sandstone, shale, or siltstone ranges from 20 to 40 inches. The soil is calcareous throughout.

Permeability of the Thedalund soil is moderate. Available water capacity is moderate. Effective rooting

depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

The Keota soil is moderately deep and well drained. It formed in calcareous loamy residuum derived from siltstone. Typically, the surface layer is pale brown loam 4 inches thick. The next 19 inches is silt loam. Below this is loam 12 inches thick. Siltstone is at a depth of 35 inches. Depth to siltstone ranges from 20 to 40 inches. The soil is calcareous throughout.

Permeability of the Keota soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is slight to moderate. The hazard of soil blowing is moderate.

This unit is used as rangeland.

The potential plant community on this unit is mainly blue grama, western wheatgrass, and fourwing saltbush. The average annual production of air-dry vegetation ranges from 500 to 1,500 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from soil blowing is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass IVe, nonirrigated. The Thedalund soil is in Loamy Plains range site, and the Keota soil is in Siltstone Plains range site.

67—Thedalund-Keota loams, 3 to 9 percent slopes. This map unit is on highly dissected alluvial fans, upland ridges, and plains.

This unit is about 45 percent Thedalund loam and about 35 percent Keota loam. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit is about 20 percent Epping silt loam, Kim loam, Mitchell silt loam, and Shingle clay loam. Also included are some areas of Rock outcrop.

The Thedalund soil is moderately deep and well drained. It formed in calcareous loamy residuum derived from fine grained sandstone, shale, and siltstone. Typically, the surface layer is grayish brown loam 3 inches thick. Below this is loam 21 inches thick. Sandstone is at a depth of 24 inches. Depth to sandstone, shale, or siltstone ranges from 20 to 40 inches. The soil is calcareous throughout.

Permeability of the Thedalund soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is medium, and the hazard of water erosion is moderate to high. The hazard of soil blowing is moderate.

The Keota soil is moderately deep and well drained. It formed in calcareous loamy residuum derived from siltstone. Typically, the surface layer is pale brown loam 4 inches thick. The next 19 inches is silt loam. Below this is loam 12 inches thick. Siltstone is at a depth of 35 inches. Depth to siltstone ranges from 20 to 40 inches. The soil is calcareous throughout.

Permeability of the Keota soil is moderate. Available water capacity is moderate. Effective rooting depth is 20 to 40 inches. Runoff is rapid, and the hazard of water erosion is moderate to high. The hazard of soil blowing is moderate.

This unit is used as rangeland.

The potential plant community on this unit is mainly blue grama, western wheatgrass, and fourwing saltbush. The average annual production of air-dry vegetation ranges from 400 to 1,300 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass VIe, nonirrigated. The Thedalund soil is in Loamy Plains range site, and the Keota soil is in Siltstone Plains range site.

68—Treon fine sandy loam, 5 to 20 percent slopes. This shallow, well drained soil is on moderately dissected to highly dissected plains and upland ridges. It formed in calcareous loamy residuum derived from fine grained sandstone.

Typically, the surface layer is brown fine sandy loam 7 inches thick. The underlying material is fine sandy loam 4 inches thick. Sandstone is at a depth of 11 inches.

Depth to sandstone ranges from 10 to 20 inches. The soil is calcareous throughout. In some areas the surface layer is sandy loam or loam.

Included in this unit are small areas of moderately deep soils, Bushman fine sandy loam, and Tassel loamy fine sand. Also included are some areas of Rock outcrop.

Permeability of this Treon soil is moderately rapid. Available water capacity is low. Effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is high. The hazard of soil blowing is high to very high.

This unit is used as rangeland.

The potential plant community on this unit is mainly blue grama, western wheatgrass, needleandthread, and sideoats grama. The average annual production of air-dry vegetation ranges from 500 to 1,200 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Mechanical treatment is not practical because of the steepness of slope. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing. Slope limits access by livestock and results in overgrazing of the less sloping areas.

This unit is poorly suited to windbreaks and environmental plantings. The main limitations are shallow rooting depth, low available water capacity, and steepness of slope.

This map unit is in capability subclass VIe, nonirrigated, and in Loamy Slopes range site.

69—Treon-Rock outcrop complex, 9 to 40 percent slopes. This map unit is on escarpments.

This unit is about 50 percent Treon fine sandy loam and about 30 percent Rock outcrop. The Treon soil is on the shoulders of escarpments, and Rock outcrop is on the backslopes of escarpments. The individual components of this unit are in areas so narrow that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Bushman soils on foot slopes and soils that have sandstone at a depth of 20 to 40 inches and are on shoulders and backslopes. Included areas make up about 20 percent of the total acreage.

The Treon soil is shallow and well drained. It formed in calcareous loamy residuum derived from fine grained sandstone. Typically, the surface layer is brown fine sandy loam 7 inches thick. The underlying material is fine sandy loam 4 inches thick. Sandstone is at a depth of 11 inches. Depth to sandstone ranges from 10 to 20 inches. The soil is calcareous throughout.

Permeability of the Treon soil is moderately rapid. Available water capacity is low. Effective rooting depth is 10 to 20 inches. Runoff is medium, and the hazard of water erosion is high to very high. The hazard of soil blowing is moderate. Rock outcrop consists of sandstone escarpments.

This unit is used as rangeland.

The potential plant community on the Treon soil is mainly blue grama, western wheatgrass, needleandthread, and sideoats grama. The average annual production of air-dry vegetation ranges from 400 to 1,200 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. Livestock grazing should be managed to protect the unit from excessive erosion. Mechanical treatment is not practical because of the areas of Rock outcrop and the steepness of slope.

If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the unit to produce plants suitable for grazing. Slope limits access by livestock and results in overgrazing of the less sloping areas.

This unit is poorly suited to windbreaks and environmental plantings. The main limitations of the Treon soil are shallow rooting depth, low available water capacity, and steepness of slope. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass VIIs, nonirrigated, and in Sandstone Breaks range site.

70—Ustic Torriorthents-Rock outcrop complex, 9 to 40 percent slopes. This map unit is on moderately dissected to highly dissected alluvial and colluvial fans and escarpments.

This unit is 60 percent Ustic Torriorthents and 20 percent Rock outcrop. Ustic Torriorthents are on the foot slopes and backslopes of fans, and Rock outcrop is on escarpments. The individual components of this unit are in areas so narrow that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Cascajo gravelly sandy loam on the shoulders of escarpments. Also included are some gullied and eroded areas. Included areas make up about 20 percent of the total acreage.

Ustic Torriorthents have a light-colored surface layer that is highly variable in texure. The subsoil, where present, ranges from silt loam to gravelly sandy loam.

Depth to bedrock ranges from 10 to 60 inches or more. These soils are calcareous throughout.

Permeability of Ustic Torriorthents is moderate to rapid. Available water capacity is moderate to high. Effective rooting depth is 10 to 60 inches or more. Runoff is slow to rapid, and the hazard of water erosion is high to very high.

Rock outcrop consists of exposures of sandstone on escarpments.

This unit is used as rangeland and for wildlife habitat.

The potential plant community on the Ustic Torriorthents is mainly sideoats grama, little bluestem, blue grama, and prairie sandreed. The average annual production of air-dry vegetation ranges from 200 to 1,000 pounds.

Management practices suitable for use on the Ustic Torriorthents are proper range use, deferred grazing, and rotation grazing. Mechanical treatment is not practical because of the stony surface and steepness of slope. Livestock grazing should be managed to protect the soils in this unit from excessive erosion. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soils to produce plants suitable for grazing. Slope limits access by livestock and results in overgrazing of the less sloping areas.

This unit is poorly suited to windbreaks and environmental plantings. The main limitations are steepness of slope, shallow depth to bedrock, and the areas of Rock outcrop.

This map unit is in capability subclass VIIs, nonirrigated, and in Sandstone Breaks range site.

71—Vona loamy sand, 0 to 3 percent slopes. This deep, somewhat excessively drained soil is on slightly dissected to moderately dissected plains. It formed in calcareous, sandy alluvial and eolian material.

Typically, the surface layer is brown loamy sand 2 inches thick. The upper 15 inches of the subsoil is sandy loam, and the lower 3 inches is calcareous sandy loam. The upper 8 inches of the substratum is calcareous loamy sand, and the lower part to a depth of 60 inches or more is calcareous sandy loam. In some areas the surface layer is sandy loam.

Included in this unit are small areas of Olney loamy sand. Included areas make up about 10 percent of the total acreage.

Permeability of this Vona soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is high.

Most areas of this unit are used as rangeland. A few areas are used as nonirrigated cropland. Winter wheat is the main crop.

The potential plant community on this unit is mainly sand bluestem, needleandthread, prairie sandreed, and switchgrass. The average annual production of air-dry vegetation ranges from 1,200 to 2,500 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. If plant cover is disturbed, protection from soil blowing is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil in this unit to produce plants suitable for grazing.

Areas that are heavily infested with undesirable plants can be improved by proper grazing management and chemical spraying. Management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing.

This unit is suited to winter wheat, barley, oats, and sorghum. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Precipitation usually is too low for crops on this unit to make efficient use of fertilizer.

Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Stubble-mulch farming, stripcropping, and minimum tillage help to control erosion and conserve moisture. Terraces reduce runoff and the risk of erosion and help to conserve moisture.

This unit is well suited to windbreaks and environmental plantings. The main limitations are moderate available water capacity and the hazard of soil blowing. Trees need to be planted directly into the native vegetation to minimize disturbance of the soil cover. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass IVe, nonirrigated, and in Deep Sand range site.

72—Vona loamy sand, 3 to 9 percent slopes. This deep, somewhat excessively drained soil is on moderately dissected to highly dissected plains. It formed in calcareous, sandy alluvial and eolian material.

Typically, the surface layer is brown loamy sand 2 inches thick. The upper 15 inches of the subsoil is sandy loam, and the lower 3 inches is calcareous sandy loam. The upper 8 inches of the substratum is calcareous loamy sand, and the lower part to a depth of 60 inches or more is calcareous sandy loam. In some areas the surface layer is sandy loam.

Included in this unit are small areas of Olney loamy sand and soils that have slopes of less than 3 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Vona soil is moderately rapid. Available water capacity is moderate. Effective rooting

depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is moderate. The hazard of soil blowing is high.

This unit is used as rangeland.

The potential plant community on this unit is mainly sand bluestem, needleandthread, prairie sandreed, and switchgrass. The average annual production of air-dry vegetation ranges from 1,100 to 2,400 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both.

If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil in this unit to produce plants suitable for grazing. Areas that are heavily infested with undesirable plants can be improved by proper grazing management and chemical spraying. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing.

This unit is well suited to windbreaks and environmental plantings. The main limitations are moderate available water capacity and the hazard of soil blowing. Trees need to be planted among the native vegetation to minimize disturbance of the plant cover. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass VIe, nonirrigated, and in Deep Sand range site.

73—Vona sandy loam, 0 to 3 percent slopes. This deep, well drained soil is on smooth to slightly dissected plains. It formed in calcareous sandy alluvial and eolian material.

Typically, the surface layer is brown sandy loam 6 inches thick. The subsoil is sandy loam 11 inches thick. The substratum to a depth of 60 inches or more is loamy sand. In some areas the surface layer is loamy sand.

Included in this unit are small areas of Olney fine sandy loam, Manter sandy loam, and Otero sandy loam.

Permeability of this Vona soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate.

This unit is used mainly as nonirrigated cropland. Winter wheat is the main crop. The unit is also used as rangeland.

This unit is suited to winter wheat, barley, oats, and sorghum. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Precipitation usually is too low for crops on this unit to make efficient use of fertilizer.

Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Stubble-mulch farming, stripcropping, and minimum tillage help to control erosion and conserve moisture. Terraces reduce runoff and the risk of erosion and help to conserve moisture.

The potential plant community on this unit is mainly blue grama, prairie sandreed, and needleandthread. The average annual production of air-dry vegetation ranges from 800 to 2,000 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from soil blowing is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. It is limited mainly by the hazard of soil blowing. Trees need to be planted among the native vegetation to minimize disturbance of the plant cover. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass VIe, nonirrigated, and in Sandy Plains range site.

74—Vona sandy loam, 3 to 9 percent slopes. This deep, well drained soil is on moderately dissected to highly dissected plains. It formed in calcareous, sandy alluvial and eolian material.

Typically, the surface layer is brown sandy loam 6 inches thick. The subsoil is sandy loam 9 inches thick. The substratum to a depth of 60 inches or more is loamy sand. In some areas the surface layer is loamy sand.

Included in this unit are small areas of Olney fine sandy loam, Manter sandy loam, and Otero sandy loam.

Permeability of this Vona soil is moderately rapid. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is moderate.The hazard of soil blowing is moderate.

This unit is used as rangeland.

The potential plant community on this unit is mainly blue grama, prairie sandreed, and needleandthread. The average annual production of air-dry vegetation ranges from 700 to 1,800 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. It is limited mainly by the hazard of soil blowing. Trees need to be planted among the native vegetation to minimize disturbance of the plant cover. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass VIe, nonirrigated, and in Sandy Plains range site.

75—Wages fine sandy loam, 0 to 6 percent slopes. This deep, well drained soil is on slightly dissected plains and alluvial fans. It formed in calcareous loamy alluvium.

Typically, the surface layer is grayish brown fine sandy loam 4 inches thick. The subsoil is sandy clay loam 10 inches thick. The substratum to a depth of 60 inches or more is calcareous loam.

Included in this unit are small areas of Kim soils, Mitchell soils, and Platner loam.

Permeability of this Wages soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow to medium, and the hazard of water erosion is slight to moderate. The hazard of soil blowing is moderate.

This unit is used as rangeland and nonirrigated cropland. Winter wheat is the main crop.

The potential plant community on this unit is mainly blue grama, western wheatgrass, sedges, and buffalograss. The average annual production of air-dry vegetation ranges from 500 to 1,500 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to winter wheat, barley, oats, and sorghum. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Precipitation usually is too low for crops on this unit to make efficient use of fertilizer.

Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Stubble-mulch farming, stripcropping, and minimum tillage help to control erosion and conserve moisture. Terraces reduce runoff and the risk of erosion and help to conserve moisture.

This unit is well suited to windbreaks and environmental plantings. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass IVe, nonirrigated, and in Loamy Plains range site.

76—Wages fine sandy loam, 6 to 9 percent slopes. This deep, well drained soil is on moderately dissected plains. It formed in calcareous loamy alluvium.

Typically, the surface layer is grayish brown fine sandy loam 4 inches thick. The subsoil is sandy clay loam 8 inches thick. The substratum to a depth of 60 inches or more is calcareous loam.

Included in this unit are small areas of Kim and Mitchell soils.

Permeability of this Wages soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium to rapid, and the hazard of water erosion is moderate. The hazard of soil blowing is moderate.

This unit is used as rangeland.

The potential plant community on this unit is mainly blue grama, western wheatgrass, sedges, and buffalograss. The average annual production of air-dry vegetation ranges from 400 to 1,300 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. Supplemental irrigation may be needed when planting and during dry periods.

This map unit is in capability subclass VIe, nonirrigated, and in Loamy Plains range site.

77—Weld loam, 0 to 6 percent slopes. This deep, well drained soil is on smooth plains. It formed in calcareous, loamy eolian material.

Typically, the surface layer is brown loam 9 inches thick. The subsoil is clay, clay loam, and silty clay loam 13 inches thick. The substratum to a depth of 60 inches or more is calcareous loam.

Included in this unit are small areas of Platner loam and soils that have a surface layer and subsoil less than 15 inches thick. Included areas make up about 15 percent of the total acreage.

Permeability of this Weld soil is slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is slight.

Most areas of this unit are used as nonirrigated cropland. Winter wheat is the main crop. A few areas are used as rangeland.

This unit is well suited to winter wheat, barley, oats, and sorghum. Low annual precipitation is the main limitation to the crops that can be grown on this unit. Because precipitation is not sufficient for annual cropping, a cropping system that includes small grain and summer fallow is most suitable. Precipitation usually is too low for crops on this unit to make efficient use of fertilizer.

Maintaining crop residue on or near the surface reduces runoff, reduces soil blowing, and helps to maintain soil tilth and organic matter content. Stubble-mulch farming, stripcropping, and minimum tillage help to control erosion and conserve moisture. Terraces reduce runoff and the risk of erosion and help to conserve moisture.

The potential plant community on this unit is mainly blue grama, western wheatgrass, sedges, and buffalograss. The average annual production of air-dry vegetation ranges from 500 to 1,500 pounds.

If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred forage plants increases. Therefore, livestock grazing should be managed so that the desired balance of preferred species is maintained in the plant community.

Range seeding is suitable if the range is in poor condition. The plants selected for seeding should meet the seasonal requirements of livestock or wildlife, or both. Other management practices that are suitable for use on this unit are proper range use, deferred grazing, and rotation grazing. If the plant cover is disturbed, protection from erosion is needed. Loss of the surface layer results in a severe decrease in productivity and in the potential of the soil to produce plants suitable for grazing.

This unit is well suited to windbreaks and environmental plantings. It has few limitations. Supplemental irrigation may be needed when planting and during dry periods. Summer fallow, cultivation for weed control, and selection of adapted plants are needed to insure establishment and survival of seedlings.

This map unit is in capability subclass IVe, nonirrigated, and in Loamy Plains range site.

prime farmland

Prime farmland, as defined by the United States Department of Agriculture, is the land that is best suited to producing food, feed, forage, fiber, and oilseed crops. It must either be used for producing food or fiber or be available for these uses. It has the soil quality, length of growing season, and moisture supply needed to economically produce a sustained high yield of crops when it is managed properly. Prime farmland produces the highest yields with minimal energy and economic resources, and farming it results in the least disturbance of the environment.

Prime farmland commonly has an adequate and dependable supply of moisture from precipitation or irrigation. It also has a favorable temperature and length of growing season and an acceptable level of acidity or alkalinity. It has few if any rock fragments and is permeable to water and air. Prime farmland is not excessively eroded or saturated with water for long periods and is not flooded during the growing season. The slope is no more than 6 percent. Soils that are limited by a hazard of flooding may qualify for prime farmland if this limitation can be overcome by practices such as flood control. Onsite investigation is needed to determine the extent of this limitation.

About 765,409 acres, or nearly 54 percent of the survey area would meet the requirements for prime farmland if an adequate and dependable supply of irrigation water were available. At present, however, only about 14,000 acres, or less than 1 percent of the area, is irrigated. The major irrigated areas are north and east of the town of Pierce and northeast of the town of Hereford. The major crops grown are corn for silage and grain, sugar beets, small grain, and dry beans. Alfalfa is the principal hay crop.

The following map units meet the soil requirements for prime farmland when irrigated; however, Haverson loam, 0 to 3 percent slopes, must also be protected from flooding to qualify as prime farmland. This list does not constitute a recommendation for a particular land use.

1—Altvan fine sandy loam, 0 to 6 percent slopes
4—Ascalon fine sandy loam, 0 to 6 percent slopes
15—Bresser sandy loam, 0 to 3 percent slopes
17—Bushman fine sandy loam, 0 to 6 percent slopes
23—Dacono clay loam, 0 to 6 percent slopes
29—Haverson loam, 0 to 3 percent slopes
30—Keith loam, 0 to 6 percent slopes
31—Kim-Mitchell complex, 0 to 6 percent slopes
34—Manter sandy loam, 0 to 6 percent slopes
36—Manzanola clay loam, 0 to 3 percent slopes
38—Nucla loam, 0 to 3 percent slopes
40—Nunn loam, 0 to 6 percent slopes
41—Nunn clay loam, 0 to 6 percent slopes
44—Olney fine sandy loam, 0 to 6 percent slopes
46—Otero sandy loam, 0 to 3 percent slopes
49—Paoli fine sandy loam, 0 to 6 percent slopes
54—Platner loam, 0 to 3 percent slopes
61—Stoneham fine sandy loam, 0 to 6 percent slopes
73—Vona sandy loam, 0 to 3 percent slopes
75—Wages fine sandy loam, 0 to 6 percent slopes
77—Weld loam, 0 to 6 percent slopes

use and management of the soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

crops and pasture

Ronald D. Miller, district conservationist, Soil Conservation Service, assisted in preparing this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; prime farmland is defined, and the map units are listed that qualify as prime farmland if irrigated; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed soil map units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

Thirty-five percent of the survey area is used as nonirrigated cropland. The major management concerns are crop selection, crop residue management, and erosion control. To maintain the productivity of the soil, conservation practices are designed to reduce annual soil losses to less than 5 tons per acre.

Crops suited to this survey area are limited because of the short growing season and the low effective annual precipitation, which is 11 to 13 inches. The major crops grown are winter wheat and sorghum. Sorghum primarily is used for hay and pasture, but it is also used as a catch crop following a loss of winter grain. Some barley and oats are grown in the area, and the oats commonly are cut for hay.

The cropping systems commonly used are wheat-fallow-wheat and wheat-fallow-sorghum-fallow. Summer fallowing is needed because of the low annual precipitation, which does not provide adequate moisture for annual cropping. During the fallow period, providing protection from soil blowing and managing crop residue are essential. Management of crop residue or stubble mulching consists of using plant residue to protect cultivated fields from erosion, to conserve moisture, to increase water infiltration, to reduce soil losses, and to improve soil tilth. Management of crop residue may be accomplished by using minimum tillage, selecting tillage equipment that leaves the maximum amount of residue on the surface, and using chemical weed control during the fallow season.

The hazard of soil blowing is a major concern in the survey area. Susceptibility to soil blowing is expressed as wind erodibility groups in table 9. Soils in wind erodibility group 2 are subject to a high hazard of soil blowing. Blakeland soils are in this group. Soils in wind erodibility groups 3 and 4 are subject to a moderate hazard of soil blowing. Altvan, Ascalon, Haverson, Renohill, and Stoneham soils are in these groups. To reduce soil blowing on the soils in wind erodibility groups 2 to 4, a combination of crop residue management, minimum tillage, and wind stripcropping is needed. Wind

stripcropping involves growing wind-resistant crops in strips alternated with row crops or fallow and arranged at right angles to the prevailing winds. Strip widths are dependent on the amount of crop residue that can be maintained during the critical soil blowing period.

Soils in wind erodibility groups 5, 6, and 8 are subject to a slight hazard of soil blowing. Dacono, Keith, Nunn, Peetz, and Weld soils are in these groups. Crop residue management and minimum tillage are needed; however, wind stripcropping may be optional.

The survey area is subject to short, high intensity rainstorms in summer. As a result, the soils in the area are subject to sheet and rill erosion from heavy runoff. The hazard of water erosion is determined by surface texture, percentage and length of slopes, the amount of rainfall, and the time and intensity of rainstorms. The hazard of erosion is given as slight, moderate, or high for each soil in the section "Detailed soil map units." Proper crop selection, crop residue management, and minimum tillage should be used to reduce soil losses. Contour farming, field stripcropping, or terracing may also be needed in some areas. If use of conservation practices does not keep soil losses at an acceptable level, establishment of permanent grass cover may be needed. Adapted grass species for seeding are listed for each soil in the section "Detailed soil map units." Further information is available at the local office of the Soil Conservation Service or the office of the Colorado State University Extension Service.

Subsurface tillage implements and stirring or mixing implements commonly are used in the survey area to achieve proper crop residue management. A combination of implements is used in seasonal cultivation to maintain the maximum amount of stubble or crop residue on the soil surface and to retain the maximum amount of soil moisture stored for the following crop by controlling weeds. Minimum tillage should be used in the survey area. This involves performing tillage operations on a timely basis and reducing the number of operations to only those essential for weed control. Use of chemicals can also be used to retard weed growth; however, use of residual herbicides is restricted to soils that have reaction of less than 7.2. Soils that have reaction of more than 7.2 should be checked very carefully to insure that residual herbicides will not harm future crops.

Soil fertility in the survey area commonly is adequate for production of small grain; however, applications of nitrogen can increase winter wheat yields. Crop response to applications of fertilizer is directly related to moisture supply. Prior to applying fertilizer, a soil test should be made to determine the amount needed and economic feasibility should be evaluated. Information on applications of fertilizer for nonirrigated cropland is available at the office of the Colorado State University Extension Service.

One percent of the survey area is irrigated cropland. The major areas are north and east of the town of Pierce and northeast of the town of Hereford. The primary source of irrigation water in the Pierce area is surface water diverted from perennial streams and delivered through irrigation canals. Deep irrigation wells are used to supplement surface water.

The major crops grown in the Pierce area are corn for silage and grain, sugar beets, small grain, and dry beans. Alfalfa is the principal hay crop. Specialty crops grown are onions and carrots. Conservation practices commonly used are proper crop rotation, crop residue management, irrigation water management, land leveling or land smoothing, ditch and canal lining, tailwater recovery systems, and underground irrigation water pipelines.

In the Hereford area, irrigation water is pumped from deep wells and applied to crops through center pivot sprinkler systems. The major crops grown in this area are corn for silage and grain, small grain, and alfalfa for hay. Conservation practices commonly used are proper crop rotation, crop residue management, proper application of irrigation water, land leveling or land smoothing, and underground irrigation water pipelines.

Approximately 86,000 acres of nonirrigated pastureland is in the survey area. The pastureland was established in the 1930's when cropland was seeded to provide protection from erosion. Most areas of the pastureland support crested wheatgrass and are managed in conjunction with native rangeland. Production of the pastureland can be increased by proper grazing management.

Other management practices used for pastureland are proper distribution of the livestock water supply, planned grazing systems, fencing, terracing for erosion control, and seeding to reestablish or improve grass stands.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil in the section "Detailed soil map units." Specific information can be obtained from the local offices of the Soil Conservation Service or the Cooperative Extension Service.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 2. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties;

appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction; effective use of crop residue; and harvesting that insures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 2 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit (*4*). Only class and subclass are used in this survey. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, wildlife habitat, or recreation.

The capability classification of each map unit is given in the section "Detailed soil map units."

rangeland

By Harvey Sprock, range conservationist, Soil Conservation Service.

About 65 percent of the survey area is rangeland. Nearly 80 percent of the income from ranches in the area is from livestock, principally cattle. Cow-calf-yearling operations are dominant. Most ranches range from 2,000 to 10,000 acres in size.

The forage produced on much of the rangeland is supplemented with pasture and small grain stubble. In winter the native forage is supplemented with hay and protein concentrate. Many ranchers use areas in the Pawnee National Grassland and in the grazing associations of this area to supplement the areas of native rangeland.

In the southern part of the area are rolling plains that support stands of short grasses. In the northern part, along the Colorado, Wyoming, and Nebraska state lines, are steep, rocky breaks that support mixed stands of short grasses and midgrasses.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

For each soil in the survey area that is suited to use as rangeland, the range site, the average annual production of vegetation, and the characteristic vegetation are given in the section "Detailed soil map units."

A range site is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range

sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was established during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

The average annual production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation.

The characteristic vegetation is the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil. The plants are listed by common name. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires a knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. Range condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

In much of the survey area, continued excessive use has reduced forage production by about half. Much of the acreage that once supported open stands of short grasses and midgrasses now supports stands of short grasses that are low in vigor and productivity. Range management practices that increase desirable species and decrease less desirable ones and that minimize erosion should be used. Rangeland inventory information and soil survey information can be used to determine proper management practices for maintaining and improving forage production.

windbreaks and environmental plantings

By Gene Anderson, woodland conservationist, Soil Conservation Service.

Windbreaks are established to protect livestock, buildings, and yards from wind and snow. They also help to protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaved and coniferous species provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind. They protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify areas, and they screen houses and other buildings from noise. The plants, mostly evergreen shrubs and trees, are closely spaced. A healthy stock of suitable species planted properly on a well-prepared site and maintained in good condition can insure a high degree of plant survival.

Land preparation can be critical for initial survival of trees and shrubs planted for windbreaks in the survey area. Good land preparation provides for weed control so that the maximum amount of water available can be used by the woody species. The 11 to 13 inches of precipitation received in this survey area annually is not adequate for survival of woody plants, so weed control or supplemental water is needed.

Dryland areas should be planted to summer fallow for at least 1 year before planting windbreaks and environmental plantings. The area to be fallowed should extend at least 20 feet on either side of the outside rows of the plantings. A survival rate of about 50 percent is expected during the first year of dryland plantings.

Various methods of providing supplemental water for windbreaks can be used. Use of drip irrigation systems greatly increases the survival rate. Drip systems are an easy way to provide a limited amount of water to each plant. Survival under drip systems averages about 93 percent for the first year.

Supplemental water also increases the growth of the plants and reduces the need for continued cultivation. The additional water eliminates the need to reduce weed competition except in areas right next to the plantings, where the weeds may compete for sunlight.

If supplemental water is used, summer fallow is not needed the year before planting. This reduces the hazard of soil blowing on the sandy soils in the survey area that tend to blow if summer fallowed. The rows for plants can be scalped; or the plants can be planted directly into the sod and an area hoed by hand. A water delivery system should then be installed to provide the necessary water for establishment of plants.

Windbreaks provide habitat for wildlife. Widely spacing rows provides more open area for wildlife feeding and also protects the trees and shrubs. Leaving at least 20 feet between rows provides room for operating farm

equipment for many years and reduces the tendency of the lower branches on the trees and shrubs to die.

Windbreaks should consist of at least two rows. The windward row should consist of shrubs, and taller trees should be planted in the row behind it. The lower growing shrubs provide protection near to the ground, and the trees provide protection from the winds at a greater height.

recreation

The soils of the survey area are rated in table 3 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 3, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 3 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 5 and interpretations for dwellings without basements and for local roads and streets in table 4.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

wildlife habitat

By Eldie W. Mustard, Jr., biologist, Soil Conservation Service.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

Historically, the grassland of the survey area supported large populations of antelope and bison. Only a few small private herds of bison are in the area now; however, antelope can still be found in large numbers.

In general, wildlife species in the area are those adapted to grassland, which comprises more than 65 percent of the area and is used mainly as rangeland. Most of the rangeland is in general map units 4, 5, 8, 9, 10, and 12.

Scattered throughout the grassland are areas of nonirrigated and irrigated cropland, breaks, badland, and beds of intermittent creeks. Cropland provides habitat for some wildlife species not found on the grassland. Examples are migrating geese and waterfowl that feed on crop residue. Areas changed from rangeland to cropland provide habitat for species such as ring-necked pheasant, which are not native to rangeland. General map units 2, 3, 11, and 13 contain much of this cropland.

The breaks and rock outcrops in general map units 6 and 7 offer habitat for wildlife species such as bobcat and peregrine falcon. The beds of intermittent creeks in general map unit 1 support cottonwood and willow trees that provide protection and cover for many species of bird as well as mule deer, white-tailed deer, antelope, and ring-necked pheasant.

Wildlife species in the area that are economically important for recreational hunting include mule deer, white-tailed deer, antelope, white-tailed and black-tailed

jackrabbits, cottontail, mourning dove, and ring-necked pheasant. Other wildlife species, important for their ecological, esthetic, and scientific value, include prairie dog, swainson's hawk, prairie falcon, meadowlark, horned lark, lark bunting, prairie rattlesnake, and kangaroo rat. Predators in the area are great horned owl, bald eagle, golden eagle, coyote, red fox, kit fox, badger, and skunk.

Range management is critical in areas where livestock and wildlife share the same habitat. Management practices that enhance rangeland wildlife habitat include livestock grazing management, range seeding, installing fences that permit movement of antelope, and providing watering developments.

engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

building site development

Table 4 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without

basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

sanitary facilities

Table 5 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 5 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 5 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 5 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium

affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 6 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 6, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to

40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 7 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering index properties

Table 8 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

physical and chemical properties

Table 9 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind

erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.
2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.
5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.
6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible. Crops can easily be grown.
7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible. Crops can easily be grown.
8. Stony or gravelly soils and other soils not subject to wind erosion.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 9, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

soil and water features

Table 10 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes are not considered flooding.

Table 10 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs, on the average, no more than once in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on

the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*5*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 11, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustoll (*Ust*, meaning dry, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Argiustolls (*Argi*, meaning subsoil with illuvial clay, plus *ustoll*, the suborder of the Mollisols that have an ustic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Aridic* identifies the subgroup that is drier than is typical for the great group. An example is Aridic Argiustolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Aridic Argiustolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*3*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*5*). Unless otherwise stated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Altvan series

The Altvan series consists of deep, well drained, moderately permeable soils on high plains and upland ridges. These soils formed in calcareous gravelly alluvium. Slope is 0 to 20 percent.

These soils are fine-loamy over sandy or sandy-skeletal, mixed, mesic Aridic Arguistolls.

Typical pedon of Altvan fine sandy loam, 6 to 9 percent slopes, 2,100 feet north and 1,400 feet west of the southeast corner of sec. 35, T. 12 N., R. 65 W.

A1—0 to 3 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable; neutral; abrupt smooth boundary.

B1t—3 to 9 inches; dark grayish brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; slightly hard, very friable; very few thin clay films on faces of peds; neutral; gradual smooth boundary.

B21t—9 to 13 inches; dark grayish brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; weak medium and coarse prismatic structure parting to moderate coarse subangular blocky; hard, friable; few thin clay films on faces of peds; neutral; clear smooth boundary.

B22t—13 to 19 inches; dark brown (10YR 4/3) sandy clay loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, friable; few thin clay films on faces of peds; neutral; abrupt wavy boundary.

C1ca—19 to 23 inches; light brown (7.5YR 6/4) sandy clay loam, light brown (7.5YR 6/4) moist; massive; hard, friable; violently effervescent; moderately alkaline; abrupt wavy boundary.

IIC2—23 to 33 inches; pink (5YR 7/3) gravelly coarse sand, reddish brown (5YR 5/3) moist; massive; soft, very friable; strongly effervescent; moderately alkaline; clear smooth boundary.

IIC3—33 to 60 inches; reddish brown (5YR 5/4) gravelly coarse sand, reddish brown (5YR 5/4) moist; massive; soft, very friable; mildly alkaline.

Thickness of the solum and depth to free carbonates range from 16 to 28 inches. The A horizon has value of 4 or 5 when dry and 2 or 3 when moist, and it has chroma of 2 or 3. The Bt horizon typically is sandy clay loam or clay loam and averages 20 to 35 percent clay. Depth to the IIC2 horizon typically is 24 to 36 inches but ranges from 20 to 40 inches. It commonly contains free carbonates.

Ascalon series

The Ascalon series consists of deep, well drained, moderately permeable soils on smooth to dissected plains and adjacent stream terraces. These soils formed in calcareous loamy alluvium. Slope is 0 to 15 percent.

These soils are fine-loamy, mixed, mesic Aridic Argiustolls.

Typical pedon of Ascalon fine sandy loam, 6 to 9 percent slopes, 150 feet west and 600 feet south of the northeast corner of sec. 36, T. 10 N., R. 65 W.

A1—0 to 8 inches; dark brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; moderate fine granular structure; slightly hard, very friable; neutral; abrupt smooth boundary.

B21t—8 to 15 inches; dark brown (10YR 4/3) sandy clay loam, dark brown (10YR 3/3) moist; strong coarse prismatic structure parting to strong medium and coarse subangular blocky; very hard, firm; many moderately thick clay films on faces of peds; neutral; clear smooth boundary.

B22t—15 to 19 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; strong coarse prismatic structure parting to strong medium and coarse subangular blocky; very hard, firm; many moderately thick clay films on faces of peds; mildly alkaline; clear smooth boundary.

B3—19 to 22 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium and coarse subangular blocky; very hard, friable; mildly alkaline; clear smooth boundary.

B3ca—22 to 26 inches; yellowish brown (10YR 5/4) sandy loam, yellowish brown (10YR 6/4) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; strongly effervescent; mildly alkaline; gradual wavy boundary.

Cca—26 to 42 inches; very pale brown (10YR 7/3) sandy loam, light yellowish brown (10YR 6/4) moist; massive; hard, very friable; violently effervescent; moderately alkaline; diffuse irregular boundary.

C2—42 to 60 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; massive; hard, very friable; strongly effervescent; moderately alkaline.

Thickness of the solum ranges from 15 to 35 inches. Depth to free carbonates ranges from 8 to 30 inches. The profile is 0 to 5 percent coarse fragments. Thickness of the mollic epipedon ranges from 7 to 18 inches.

The A horizon has value of 4 or 5 when dry and 2 or 3 when moist, and it has chroma of 2 or 3. The B horizon commonly is sandy clay loam, but in some pedons it is clay loam, heavy loam, or heavy sandy loam. It is neutral or mildly alkaline. The C horizon is moderately alkaline or strongly alkaline.

Avar series

The Avar series consists of deep, well drained, very slowly permeable soils in depressional areas and swales and on terraces that are adjacent to flood plains. These soils formed in calcareous loamy alluvium. Slope is 0 to 3 percent.

These soils are fine-loamy, mixed, mesic Ustollic Natrargids.

Typical pedon of Avar fine sandy loam, 800 feet south and 900 feet east of the northwest corner of sec. 17, T. 9 N., R. 61 W.

A2—0 to 3 inches; light brownish gray (10YR 6/2) fine sandy loam, brown (10YR 4/3) moist; moderate medium platy structure; slightly hard, very friable; strongly alkaline (pH 8.8); abrupt smooth boundary.

B2t—3 to 8 inches; brown (10YR 5/3) heavy clay loam, brown (10YR 3/3) moist; moderate medium

columnar structure parting to moderate fine and medium subangular blocky; very hard, very firm; common moderately thick clay films on faces of peds; slightly effervescent; very strongly alkaline (pH 9.8); clear smooth boundary.

B3sa—8 to 11 inches; brown (10YR 5/3) sandy clay loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; hard, firm; strongly effervescent; very strongly alkaline (pH 9.8); clear smooth boundary.

C1sa—11 to 23 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 4/3) moist; massive; slightly hard, very friable; strongly effervescent; very strongly alkaline (pH 9.8); gradual smooth boundary.

C2casa—23 to 38 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 6/3) moist; weak medium and coarse subangular blocky structure; slightly hard, friable; violently effervescent; very strongly alkaline (pH 9.8); gradual wavy boundary.

A2bcasa—38 to 50 inches; very pale brown (10YR 7/3) sandy clay loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable; violently effervescent; very strongly alkaline (pH 9.9); gradual wavy boundary.

B2tbcasa—50 to 60 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; moderate medium prismatic structure parting to moderate medium and coarse subangular blocky; hard, friable; common thin clay films on faces of peds and bridging mineral grains; common medium soft masses and concretions of lime; violently effervescent; very strongly alkaline (pH 9.8).

Thickness of the solum ranges from 6 to 14 inches. Depth to the base of the natric horizon typically is less than 10 inches. Content of coarse fragments in the profile commonly is less than 5 percent but ranges from 0 to 10 percent. Depth to free carbonates is 0 to 15 inches. A buried horizon is in some pedons. Depth to the water table is 5 to 10 feet.

The A horizon has value of 5 or 6 when dry and 3 or 4 when moist, and it has chroma of 1 to 3. Some profiles have a thin A1 horizon, but most have a light-colored A2 horizon. The B horizon commonly is heavy clay loam or clay. The percentage of exchangeable sodium is more than 13 in the B horizon and increases with depth. Electrical conductivity is more than 4 millimhos in the B horizon and increases with depth. The C horizon and buried horizons are strongly alkaline or very strongly alkaline.

Bankard series

The Bankard series consists of deep, well drained to somewhat excessively drained, rapidly permeable to very rapidly permeable soils on flood plains. These soils formed in stratified, calcareous sandy alluvium. Slope is 0 to 3 percent.

These soils are sandy, mixed, mesic Ustic Torrifluvents.

Typical pedon of Bankard loamy fine sand, 0 to 3 percent slopes, 150 feet west and 100 feet north of the southwest corner of sec. 31, T. 11 N., R. 61 W.

A11—0 to 6 inches; brown (10YR 5/3) loamy fine sand, dark grayish brown (10YR 4/2) moist; moderate coarse granular structure; soft, very friable; strongly effervescent; moderately alkaline; abrupt smooth boundary.

A12—6 to 9 inches; grayish brown (10YR 5/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak coarse granular structure; soft, very friable; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C1—9 to 19 inches; pale brown (10YR 6/3) loamy sand that has thin lenses of loamy fine sand and sand, brown (10YR 4/3) moist; weak medium granular structure; slightly hard, very friable; less than 3 percent gravel; strongly effervescent; strongly alkaline; clear smooth boundary.

C2—19 to 34 inches; light brownish gray (10YR 6/2) sand that has thin lenses of fine sand and gravelly sand, brown (10YR 5/3) moist; single grain; loose; 5 to 10 percent gravel; slightly effervescent; moderately alkaline; clear wavy boundary.

C3—34 to 43 inches; pale brown (10YR 6/3) gravelly sand that has thin lenses of sand and very gravelly sand, brown (10YR 5/3) moist; single grain; loose; 20 percent gravel; slightly effervescent; moderately alkaline; clear wavy boundary.

IIC4—43 to 60 inches; pale brown (10YR 6/3) very gravelly sand that has thin lenses of sand and gravelly sand, brown (10YR 5/3) moist; single grain; loose; 43 percent gravel; slightly effervescent; moderately alkaline.

Depth to free carbonates ranges from 0 to 7 inches. The content of rock fragments in the control section ranges from 0 to 35 percent but commonly is less than 20 percent. The A horizon has value of 5 or 6 when dry and 3 to 5 when moist, and it has chroma of 2 or 3. Content of rock fragments in the A11 horizon ranges from 0 to 15 percent but commonly is less than 5 percent.

Blakeland series

The Blakeland series consists of deep, somewhat excessively drained, rapidly permeable soils on alluvial and colluvial fans. These soils formed in arkosic sand. Slope is 0 to 20 percent.

These soils are sandy, mixed, mesic Torriorthentic Haplustolls.

Typical pedon of Blakeland loamy sand, 6 to 12 percent slopes, 2,400 feet south and 200 feet west of the northeast corner of sec. 26, T. 11 N., R. 59 W.

A1—0 to 15 inches; dark grayish brown (10YR 4/2) loamy sand, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, very friable; neutral; gradual smooth boundary.
C—15 to 60 inches; brown (10YR 5/3) loamy sand, dark brown (10YR 4/3) moist; massive; soft, very friable; neutral.

Thickness of the mollic epipedon ranges from 7 to 20 inches. Depth to free carbonates ranges from 40 to 60 inches or more. The profile is 0 to 15 percent coarse fragments. The control section commonly is loamy sand, but in some pedons it is sand. It is neutral or mildly alkaline. The A horizon has value of 4 or 5 when dry and 2 or 3 when moist, and it has chroma of 1 to 3.

Bresser series

The Bresser series consists of deep, well drained, moderately permeable soils on smooth to dissected high plains. These soils formed in sandy alluvium. Slope is 0 to 9 percent.

These soils are fine-loamy, mixed, mesic Aridic Argiustolls.

Typical pedon of Bresser sandy loam, 0 to 3 percent slopes, 5 feet north and 5 feet east of the southwest corner of sec. 19, T. 11 N., R. 56 W.

A1—0 to 15 inches; dark grayish brown (10YR 4/2) coarse sandy loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, very friable; neutral; clear wavy boundary.
B21t—15 to 19 inches; grayish brown (10YR 5/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; moderate coarse prismatic structure parting to moderate coarse subangular blocky; slightly hard, very friable; common thin clay films lining interstitial pores; neutral; gradual wavy boundary.
B22t—19 to 34 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; moderate coarse prismatic structure parting to moderate coarse subangular blocky; extremely hard, very firm; common thin clay films lining interstitial pores; neutral; gradual wavy boundary.
B3—34 to 37 inches; grayish brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure; very hard, firm; neutral; gradual wavy boundary.
C1—37 to 47 inches; grayish brown (10YR 5/2) loamy coarse sand, brown (10YR 4/3) moist; massive; soft, very friable; neutral; clear wavy boundary.
C2—47 to 60 inches; pale brown (10YR 6/3) loamy coarse sand, brown (10YR 5/3) moist; single grain; loose; mildly alkaline.

Thickness of the solum ranges from 20 to 38 inches. Depth to free carbonates is more than 60 inches.

Thickness of the mollic epipedon ranges from 10 to 20 inches. The A horizon has value of 4 or 5 when dry and 2 or 3 when moist, and it has chroma of 1 to 3. The B horizon commonly is sandy clay loam, but in some pedons it is clay loam. It is slightly acid to mildly alkaline. The C horizon is neutral or mildly alkaline.

Bushman series

The Bushman series consists of deep, well drained, moderately rapidly permeable soils on dissected alluvial and colluvial fans and on upland ridges. These soils formed in calcareous loamy alluvium and colluvium. Slope is 0 to 20 percent.

These soils are coarse-loamy, mixed, mesic Torriorthentic Haplustolls.

Typical pedon of Bushman fine sandy loam, 3 to 9 percent slopes, 100 feet south and 2,100 feet west of the northeast corner of sec. 28, T. 12 N., R. 64 W.

A11—0 to 6 inches; brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure parting to weak fine granular; slightly hard, very friable; 5 percent gravel; mildly alkaline; abrupt smooth boundary.
A12—6 to 12 inches; brown (10YR 5/3) sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse subangular blocky structure parting to weak fine granular; slightly hard, very friable; 5 percent gravel; violently effervescent; mildly alkaline; clear smooth boundary.
AC—12 to 19 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 4/3) moist; weak coarse subangular blocky structure; slightly hard, very friable; 5 percent gravel; disseminated lime; violently effervescent; moderately alkaline; clear smooth boundary.
C1—19 to 33 inches; very pale brown (10YR 7/3) very fine sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; 15 percent gravel; disseminated lime; violently effervescent; moderately alkaline; gradual smooth boundary.
C2—33 to 60 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; 5 percent gravel; disseminated lime; violently effervescent; moderately alkaline.

Thickness of the mollic epipedon ranges from 7 to 12 inches. The profile commonly has free carbonates at the surface, but in some pedons they are leached to a depth of 4 to 6 inches. The profile is 0 to 20 percent coarse fragments. The control section commonly is sandy loam, but in some pedons it is loam. It is mildly alkaline to moderately alkaline. The A horizon has value of 4 or 5 when dry and 2 or 3 when moist, and it has chroma of 2 or 3.

Canyon series

The Canyon series consists of shallow, well drained, moderately permeable soils on dissected upland ridges and knolls. These soils formed in partially consolidated, limy, loamy residuum derived from sandstone. Slope is 0 to 20 percent.

These soils are loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents.

Typical pedon of a Canyon gravelly loam in an area of Bushman-Curabith-Canyon complex, 0 to 20 percent slopes, about 3,100 feet west and 150 feet south of the northeast corner of sec. 28, T. 12 N., R. 56 W.

A1—0 to 3 inches; dark grayish brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; 15 to 20 percent sandstone fragments; mildly alkaline; clear smooth boundary.

AC—3 to 7 inches; grayish brown (10YR 5/2) gravelly loam, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure; soft, very friable; 15 to 20 percent sandstone fragments; strongly effervescent; mildly alkaline; gradual smooth boundary.

C1—7 to 14 inches; very pale brown (10YR 7/3) gravelly loam, brown (10YR 5/3) moist; massive; slightly hard, friable; 20 percent sandstone fragments; violently effervescent; moderately alkaline; abrupt irregular boundary.

C2r—14 inches; limy sandstone.

Depth to free carbonates ranges from 0 to 3 inches. The profile is 15 to 25 percent coarse fragments. Depth to sandstone is 10 to 20 inches. The A horizon has value of 4 or 5 when dry and 3 or 4 when moist, and it has chroma of 2 or 3. The C horizon commonly is gravelly loam, but in some pedons it is very fine sandy loam. It is mildly alkaline or moderately alkaline.

Cascajo series

The Cascajo series consists of deep, excessively drained, rapidly permeable soils on dissected upland ridges and breaks. These soils formed in calcareous gravelly alluvium. Slope is 5 to 20 percent.

These soils are sandy-skeletal, mixed, mesic Ustollic Calciorthids.

Typical pedon of Cascajo gravelly sandy loam, 5 to 20 percent slopes, 150 feet east and 950 feet south of the northwest corner of sec. 17, T. 9 N., R. 63 W.

A1—0 to 3 inches; dark grayish brown (10YR 4/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; slightly hard, very friable; 30 percent gravel; mildly alkaline; clear smooth boundary.

AC—3 to 12 inches; brown (10YR 5/3) very gravelly loamy coarse sand, brown (10YR 4/3) moist; weak very fine granular structure; slightly hard, very friable; 60 percent gravel; slightly effervescent; mildly alkaline; gradual wavy boundary.

C1ca—12 to 24 inches; pale brown (10YR 6/3) very gravelly loamy coarse sand, brown (10YR 5/3) moist; massive; slightly hard, very friable; 45 percent gravel; violently effervescent; mildly alkaline; gradual irregular boundary.

C2—24 to 60 inches; pale brown (10YR 6/3) very gravelly coarse sand, brown (10YR 5/3) moist; massive; soft, very friable; 35 percent gravel; strongly effervescent.

Depth to free carbonates ranges from 0 to 5 inches. The control section is 35 to 75 percent coarse fragments. It commonly is very gravelly coarse sand, but in some pedons it is very gravelly loamy coarse sand. The control section is mildly alkaline or moderately alkaline. The A horizon has value of 4 or 5 when dry and 3 or 4 when moist, and it has chroma of 2 to 4.

Curabith series

The Curabith series consists of deep, well drained, moderately permeable soils on smooth to dissected plains and on upland ridges. These soils formed in calcareous loamy alluvium. Slope is 0 to 20 percent.

These soils are loamy-skeletal, mixed, mesic Aridic Calciustolls.

Typical pedon of a Curabith loam in an area of Ascalon-Bushman-Curabith complex, 3 to 15 percent slopes, 2,640 feet east and 500 feet south of the northwest corner of sec. 23, T. 12 N., R. 59 W.

A1—0 to 10 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, very friable; 5 percent channery fragments; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C1ca—10 to 25 inches; very pale brown (10YR 7/3) very channery sandy loam, light yellowish brown (10YR 6/4) moist; massive; soft, very friable; 45 percent channery fragments and 15 percent flagstones; lime coatings on coarse fragments; violently effervescent; strongly alkaline; clear smooth boundary.

C2—25 to 42 inches; pink (7.5YR 7/4) channery sandy loam, strong brown (7.5YR 5/6) moist; massive; soft, very friable; 25 percent channery fragments and 5 percent flagstones; lime coatings on coarse fragments; strongly effervescent; strongly alkaline; diffuse wavy boundary.

C3—42 to 60 inches; pink (7.5YR 7/3) very channery loamy sand, light brown (7.5YR 6/4) moist; massive; soft, very friable; 35 percent channery fragments and 35 percent flagstones; lime coatings on coarse fragments; strongly effervescent; strongly alkaline.

Thickness of the mollic epipedon ranges from 7 to 10 inches. The profile typically is calcareous. Rock

fragments are common in all horizons. The A horizon has value of 4 or 5 when dry and 2 or 3 when moist, and it has chroma of 2 or 3. The C horizon is 8 to 20 percent clay. It is moderately alkaline or strongly alkaline.

Cushman series

The Cushman series consists of moderately deep, well drained, moderately permeable soils on dissected plains. These soils formed in calcareous loamy residuum derived from interbedded sandstone and shale. Slope is 0 to 9 percent.

These soils are fine-loamy, mixed, mesic Ustollic Haplargids.

Typical pedon of Cushman fine sandy loam, 0 to 6 percent slopes, 1,300 feet east and 1,000 feet north of the southwest corner of sec. 33, T. 10 N., R. 58 W.

A1—0 to 6 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; moderate medium and coarse granular structure; soft, very friable; mildly alkaline; clear smooth boundary.

B1—6 to 10 inches; dark brown (10YR 4/3) fine sandy loam, dark brown (10YR 4/3) moist; weak medium prismatic structure parting to moderate medium subangular blocky; hard, very friable; very few thin clay films bridging mineral grains; mildly alkaline; clear smooth boundary.

B2t—10 to 21 inches; light yellowish brown (2.5YR 6/4) clay loam, light olive brown (2.5YR 5/4) moist; moderate fine prismatic structure parting to moderate fine subangular blocky; hard, very friable; continuous moderately thick clay films on faces of peds; strongly effervescent; moderately alkaline; gradual smooth boundary.

Cca—21 to 29 inches; pale yellow (2.5YR 7/4) clay loam, light olive brown (2.5YR 5/4) moist; massive; hard, friable; violently effervescent; moderately alkaline; gradual wavy boundary.

Cr—29 to 60 inches; olive interbedded calcareous sandstone and shale.

Thickness of the solum is 15 to 25 inches. Depth to free carbonates is 7 to 10 inches. Depth to bedrock is 20 to 40 inches. The profile is 0 to 15 percent coarse fragments. The A horizon has value of 4 or 5 when dry and 3 or 4 when moist, and it has chroma of 2 or 3. The B horizon commonly is clay loam, but in some pedons it is loam or sandy clay loam. It is mildly alkaline or moderately alkaline.

Dacono series

The Dacono series consists of deep, well drained, moderately slowly permeable soils on smooth to dissected plains and adjacent stream terraces. These soils formed in calcareous loamy alluvium. Slope is 0 to 6 percent.

These soils are clayey over sandy or sandy-skeletal, montmorillonitic, mesic Aridic Argiustolls.

Typical pedon of Dacono clay loam, 0 to 6 percent slopes, 200 feet east and 2,645 feet north of the southwest corner of sec. 7, T. 11 N., R. 60 W.

Ap—0 to 4 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine crumb structure; slightly hard, very friable; neutral; clear smooth boundary.

B21t—4 to 7 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; slightly hard, very friable; neutral; clear smooth boundary.

B22t—7 to 15 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; weak medium and coarse prismatic structure parting to weak medium subangular blocky; hard, friable; few thin clay films on faces of peds; neutral; clear smooth boundary.

C1ca—15 to 21 inches; pale brown (10YR 6/3) heavy clay loam, brown (10YR 5/3) moist; massive; slightly hard, friable; violently effervescent; moderately alkaline; clear smooth boundary.

C2ca—21 to 26 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; massive; slightly hard, friable; violently effervescent; few fine rounded soft masses and concretions of lime; moderately alkaline; clear wavy boundary.

IIC2—26 to 39 inches; pale brown (10YR 6/3) very gravelly loamy sand, yellowish brown (10YR 5/4) moist; single grain; loose; strongly effervescent; moderately alkaline; clear smooth boundary.

IIC3—39 to 60 inches; pale brown (10YR 6/3) coarse sand, yellowish brown (10YR 5/4) moist; single grain; loose; strongly effervescent; moderately alkaline.

Thickness of the solum ranges from 15 to 30 inches. Depth to free carbonates ranges from 8 to 20 inches. The solum is 0 to 5 percent coarse fragments. Thickness of the mollic epipedon ranges from 7 to 15 inches. Depth to the IIC horizon is 20 to 40 inches. The A horizon has value of 4 or 5 when dry and 2 or 3 when moist, and it has chroma of 1 to 3. The B horizon commonly is clay, but in some pedons it is clay loam. It is neutral to moderately alkaline.

Dix series

The Dix series consists of deep, excessively drained, rapidly permeable to very rapidly permeable soils on dissected upland ridges and breaks. These soils formed in gravelly alluvium. Slope is 6 to 20 percent.

These soils are sandy-skeletal, mixed, mesic Torriorthentic Haplustolls.

Typical pedon of a Dix gravelly loamy sand in an area of Eckley-Dix-Blakeland complex, 6 to 20 percent slopes, 200 feet east and 1,000 feet north of the southwest corner of sec. 9, T. 11 N., R. 57 W.

A1—0 to 12 inches; dark grayish brown (10YR 4/2) gravelly loamy sand, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable; 20 percent gravel; slightly acid; gradual wavy boundary.
AC—12 to 15 inches; brown (10YR 5/3) very gravelly sand, dark brown (10YR 3/3) moist; single grain; loose; 35 percent gravel; neutral; gradual wavy boundary.
C1—15 to 24 inches; very pale brown (10YR 7/4) very gravelly sand, light yellowish brown (10YR 6/4) moist; single grain; loose; 35 percent gravel; neutral; gradual wavy boundary.
IIC2—24 to 37 inches; very pale brown (10YR 7/4) very gravelly coarse sand, light yellowish brown (10YR 6/4) moist; single grain; loose; 45 percent gravel; neutral; clear smooth boundary.
IIIC3—37 to 60 inches; very pale brown (10YR 7/4) gravelly sand, light yellowish brown (10YR 6/4) moist; single grain; loose; 30 percent gravel; neutral.

Thickness of the mollic epipedon ranges from 7 to 15 inches. Depth to free carbonates is more than 60 inches. The profile is 15 to 50 percent coarse fragments. The control section commonly is very gravelly sand, but in some pedons it is very gravelly loamy sand. It is neutral or mildly alkaline. The A horizon has value of 4 or 5 when dry and 2 or 3 when moist, and it has chroma of 2 or 3.

Eckley series

The Eckley series consists of deep, well drained, moderately permeable soils on smooth high plains and upland ridges. These soils formed in gravelly alluvium. Slope is 0 to 20 percent.

These soils are fine-loamy over sandy or sandy-skeletal, mixed, mesic Aridic Argiustolls.

Typical pedon of Eckley sandy clay loam, 0 to 6 percent slopes, 400 feet north and 1,400 feet east of the southwest corner of sec. 5, T. 11 N., R. 57 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, friable; neutral; abrupt smooth boundary.
B21t—9 to 12 inches; brown (10YR 4/3) heavy sandy clay loam, dark brown (10YR 3/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable; common thin clay films on faces of peds; neutral; clear wavy boundary.
B22t—12 to 15 inches; yellowish brown (10YR 5/4) gravelly sandy clay loam, dark yellowish brown (10YR 4/4) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, friable; common thin clay films on faces of peds; 20 percent gravel; neutral; clear wavy boundary.
IIC—15 to 60 inches; very pale brown (10YR 7/4) gravelly sand, light yellowish brown (10YR 6/4) moist; single grain; loose; 20 percent gravel; neutral.

Thickness of the solum is 12 to 15 inches. Depth to free carbonates commonly is more than 60 inches, but it ranges from 30 to 60 inches. The profile is 15 to 30 percent coarse fragments. Thickness of the mollic epipedon ranges from 10 to 15 inches. The A horizon has value of 4 or 5 when dry and 2 or 3 when moist, and it has chroma of 1 to 3. The B horizon commonly is sandy clay loam, but in some pedons it is gravelly sandy clay loam. The C horizon is neutral or mildly alkaline.

Epping series

The Epping series consists of shallow, well drained, moderately permeable soils on dissected plains. These soils formed in calcareous loamy residuum derived from siltstone. Slope is 0 to 9 percent.

These soils are loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents.

Typical pedon of Epping silt loam, 0 to 9 percent slopes, 100 feet west and 1,350 feet north of the southeast corner of sec. 14, T. 9 N., R. 58 W.

A1—0 to 3 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak very fine granular structure; soft, very friable; neutral; abrupt smooth boundary.
C1—3 to 15 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; weak coarse subangular blocky structure; soft, very friable; disseminated lime; violently effervescent; moderately alkaline; clear wavy boundary.
C2—15 to 17 inches; pale brown (10YR 6/3) silt loam, dark brown (10YR 4/3) moist; weak very fine granular structure; soft, very friable; disseminated lime; violently effervescent; moderately alkaline; abrupt smooth boundary.
R—17 inches; siltstone.

Depth to free carbonates ranges from 0 to 3 inches. The profile is 0 to 15 percent coarse fragments. Depth to siltstone is 10 to 20 inches. The control section commonly is silt loam, but in some pedons it is loam. The profile is neutral to moderately alkaline. The A horizon has value of 6 or 7 when dry and 3 or 4 when moist, and it has chroma of 2 or 3.

Haverson series

The Haverson series consists of deep, well drained, moderately permeable soils on flood plains and adjacent stream terraces. These soils formed in stratified, calcareous, loamy alluvium. Slope is 0 to 3 percent.

These soils are fine-loamy, mixed (calcareous), mesic Ustic Torrifluvents.

Typical pedon of Haverson loam, 0 to 3 percent slopes, 1,320 feet south and 1,320 feet east of the northwest corner of sec. 36, T. 10 N., R. 64 W.

A11—0 to 3 inches; pale brown (10YR 6/3) loam, dark brown (10YR 3/3) moist; strong fine granular structure; slightly hard, very friable; violently effervescent; mildly alkaline; clear smooth boundary.
A12—3 to 6 inches; pale brown (10YR 6/3) loam, dark brown (10YR 3/3) moist; weak fine and medium granular structure; hard, friable; strongly effervescent; mildly alkaline; abrupt smooth boundary.
A13—6 to 12 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak coarse subangular blocky structure; very hard, friable; strongly effervescent; mildly alkaline; clear smooth boundary.
C1—12 to 32 inches; pale brown (10YR 6/3) very fine sandy loam that has thin lenses of loam, brown (10YR 4/3) moist; massive; hard, friable; strongly effervescent; mildly alkaline; gradual smooth boundary.
C2—32 to 60 inches; pale brown (10YR 6/3) loam that has thin lenses of sandy loam and very fine sandy loam, brown (10YR 4/3) moist; massive; slightly hard, very friable; few fine irregularly shaped soft masses and seams of lime; strongly effervescent; moderately alkaline.

Depth to free carbonates ranges from 0 to 5 inches. The control section is variable in texture because it has thin strata of fine sand, silt, and sandy loam. It commonly is loam, but in some pedons it is very fine sandy loam or clay loam. The control section is 18 to 35 percent clay and 15 to 35 percent sand that is fine or coarser. The profile is mildly alkaline to strongly alkaline. The A horizon has value of 5 or 6 when dry and 3 to 5 when moist, and it has chroma of 2 or 3.

Keith series

The Keith series consists of deep, well drained, moderately permeable soils on smooth to dissected plains, in swales, and on stream terraces. These soils formed in calcareous loamy alluvium. Slope is 0 to 6 percent.

These soils are fine-silty, mixed, mesic Aridic Argiustolls.

Typical pedon of Keith loam, 0 to 6 percent slopes, 2,100 feet east and 2,500 feet north of the southwest corner of sec. 13, T. 9 N., R. 59 W.

A1—0 to 4 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; soft, very friable; neutral; clear smooth boundary.
B2t—4 to 15 inches; dark grayish brown (10YR 4/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable; few thin clay films on faces of peds; neutral; clear smooth boundary.
B3ca—15 to 20 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; slightly hard, friable; disseminated secondary carbonates; strongly effervescent; mildly alkaline; clear smooth boundary.
C1ca—20 to 37 inches; light gray (10YR 7/2) silt loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, friable; few fine irregularly shaped seams and soft masses of lime; violently effervescent; moderately alkaline; gradual wavy boundary.
C2—37 to 60 inches; pale brown (10YR 6/3) silt loam, dark grayish brown (10YR 4/2) moist; massive; soft, friable; secondary carbonates; violently effervescent; moderately alkaline.

Thickness of the solum is 16 to 30 inches. Thickness of the mollic epipedon is 9 to 18 inches. Depth to free carbonates is 15 to 27 inches. The profile is 0 to 5 percent coarse fragments. The A horizon has value of 4 or 5 when dry and 2 or 3 when moist. The B horizon commonly is silt loam, but in some pedons it is silty clay loam. It is neutral to moderately alkaline. The C horizon is mildly alkaline or moderately alkaline.

Keota series

The Keota series consists of moderately deep, well drained, moderately permeable soils on dissected alluvial fans, upland ridges, and plains. These soils formed in calcareous loamy residuum derived from siltstone. Slope is 0 to 9 percent.

These soils are coarse-silty, mixed (calcareous), mesic Ustic Torriorthents.

Typical pedon of a Keota loam in an area of Thedalund-Keota loams, 3 to 9 percent slopes, 600 feet north and 400 feet west of the southeast corner of sec. 25, T. 11 N., R. 65 W.

A1—0 to 4 inches; pale brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; weak fine granular structure; soft, very friable; strongly effervescent; moderately alkaline; abrupt smooth boundary.
AC—4 to 6 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; weak fine granular structure; soft, very friable; violently effervescent; moderately alkaline; abrupt smooth boundary.
C1—6 to 10 inches; very pale brown (10YR 7/4) silt loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; soft, very friable; violently effervescent; moderately alkaline; abrupt smooth boundary.
C2—10 to 23 inches; very pale brown (10YR 8/4) silt loam, light yellowish brown (10YR 6/4) moist; weak

medium subangular blocky structure; soft, very friable; violently effervescent; moderately alkaline; abrupt wavy boundary.
C3—23 to 35 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; massive; soft, very friable; strongly effervescent; moderately alkaline; abrupt wavy boundary.
C4r—35 inches; calcareous siltstone.

These soils commonly have free carbonates at the surface. Depth to bedrock is 20 to 40 inches. The profile is 0 to 5 percent coarse fragments. The control section commonly is silt loam, but in some pedons it is loam. It is moderately alkaline or strongly alkaline. The A horizon has value of 5 to 7 when dry and 4 or 5 when moist, and it has chroma of 3 or 4. It is mildly alkaline or moderately alkaline.

Kim series

The Kim series consists of deep, well drained, moderately permeable soils on smooth to dissected plains and alluvial and colluvial fans. These soils formed in calcareous loamy alluvium and colluvium. Slope is 0 to 30 percent.

These soils are fine-loamy, mixed (calcareous), mesic Ustic Torriorthents.

Typical pedon of a Kim loam in an area of Kim-Mitchell complex, 0 to 6 percent slopes, 2,640 feet east and 100 feet south of the northwest corner of sec. 13, T. 9 N., R. 61 W.

A1—0 to 3 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; soft, very friable; slightly effervescent; moderately alkaline; clear smooth boundary.
AC—3 to 7 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; hard, friable; strongly effervescent; moderately alkaline; clear smooth boundary.
C—7 to 60 inches; light gray (10YR 7/2) loam, brown (10YR 5/3) moist; massive; slightly hard, friable; strongly effervescent; moderately alkaline.

Depth to free carbonates is 0 to 5 inches. The profile is 0 to 5 percent coarse fragments, primarily siltstone chips. The control section commonly is loam, but in some pedons it is clay loam, very fine sandy loam, or silt loam. It is more than 18 percent clay and more than 15 percent sand that is fine or coarser. The A horizon has value of 5 to 7 when dry and 3 to 6 when moist, and it has chroma of 2 to 4. It is mildly alkaline or moderately alkaline.

Manter series

The Manter series consists of deep, well drained, moderately rapidly permeable soils on dissected plains. These soils formed in calcareous loamy alluvium. Slope is 0 to 9 percent.

These soils are coarse-loamy, mixed, mesic Aridic Argiustolls.

Typical pedon of Manter sandy loam, 6 to 9 percent slopes, 2,445 feet south and 1,470 feet east of the northwest corner of sec. 16, T. 10 N., R. 65 W.

A1—0 to 3 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; moderate medium granular structure; slightly hard, very friable; neutral; abrupt smooth boundary.
B21t—3 to 14 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; hard, friable; common thin patchy clay films on faces of peds; neutral; clear smooth boundary.
B22t—14 to 16 inches; pale brown (10YR 6/3) sandy loam, dark brown (10YR 4/3) moist; weak coarse subangular blocky structure; hard, friable; common thin clay films on faces of peds; mildly alkaline; clear smooth boundary.
B3ca—16 to 21 inches; very pale brown (10YR 7/3) sandy loam, brown (10YR 5/3) moist; weak coarse subangular blocky structure; slightly hard, very friable; violently effervescent; mildly alkaline; clear smooth boundary.
C1ca—21 to 28 inches; very pale brown (10YR 8/4) sandy loam, light yellowish brown (10YR 6/4) moist; massive; slightly hard, very friable; common medium irregularly shaped soft masses of lime; violently effervescent; moderately alkaline; gradual smooth boundary.
C2ca—28 to 60 inches; very pale brown (10YR 8/3) loamy sand, pale brown (10YR 6/3) moist; massive; soft, very friable; few fine irregularly shaped soft masses of lime; violently effervescent; moderately alkaline.

Thickness of the solum ranges from 15 to 30 inches. Thickness of the mollic epipedon ranges from 7 to 18 inches. The A horizon has value of 4 or 5 when dry and 2 or 3 when moist, and it has chroma of 2 or 3. The B horizon commonly is sandy loam, but in some pedons it is fine sandy loam. It is neutral or mildly alkaline.

Manzanola series

The Manzanola series consists of deep, well drained, slowly permeable soils on smooth plains, in swales, and on adjacent stream terraces. These soils formed in calcareous clayey alluvium. Slope is 0 to 3 percent.

These soils are fine, montmorillonitic, mesic Ustollic Haplargids.

Typical pedon of Manzanola clay loam, 0 to 3 percent slopes, 50 feet west of the center of sec. 1, T. 8 N., R. 65 W.

A1—0 to 3 inches; grayish brown (2.5Y 5/2) heavy clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate medium granular structure; hard, very friable; mildly alkaline; clear smooth boundary.
B21t—3 to 7 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate medium subangular blocky structure; hard, firm; thin continuous clay films on faces of peds; mildly alkaline; gradual wavy boundary.
B22t—7 to 18 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; strong medium prismatic structure parting to moderate medium angular blocky; very hard, firm; moderately thick continuous clay films on faces of peds; slightly effervescent; mildly alkaline; gradual wavy boundary.
B3ca—18 to 25 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, firm; thin nearly continuous clay films on faces of some peds; strongly effervescent; moderately alkaline; clear wavy boundary.
C1ca—25 to 48 inches; grayish brown (2.5Y 5/2) clay, grayish brown (2.5Y 5/2) moist; massive; very hard, firm; strongly effervescent; moderately alkaline; clear wavy boundary.
C2—48 to 60 inches; grayish brown (2.5Y 5/2) light clay loam, grayish brown (2.5Y 5/2) moist; massive; very hard, firm; slightly effervescent; moderately alkaline.

Thickness of the solum ranges from 15 to 38 inches. Depth to free carbonates ranges from 0 to 8 inches. The A horizon has value of 5 or 6 when dry and 3 or 4 when moist, and it has chroma of 2 or 3. The B horizon commonly is clay, but in some pedons it is heavy clay loam.

Midway series

The Midway series consists of shallow, well drained, slowly permeable soils on dissected plains, breaks, and upland ridges. These soils formed in calcareous clayey residuum derived from shale. Slope is 0 to 9 percent.

These soils are clayey, montmorillonitic (calcareous), mesic, shallow Ustic Torriorthents.

Typical pedon of Midway clay loam, 0 to 9 percent slopes, 2,450 feet west and 250 feet north of the southeast corner of sec. 34, T. 9 N., R. 63 W.

A1—0 to 3 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium granular structure; slightly hard, friable; neutral; clear smooth boundary.
AC—3 to 11 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; moderate thin platy structure parting to moderate fine granular; slightly hard, friable; strongly effervescent; mildly alkaline; gradual wavy boundary.
Cr—11 inches; variegated, calcareous clayey shale.

Depth to free carbonates is 0 to 3 inches. The profile is 0 to 15 percent coarse fragments. Depth to shale is 10 to 20 inches. The A horizon has value of 5 or 6 when dry and 3 or 4 when moist, and it has chroma of 2 to 4. The C horizon is heavy clay loam to light clay and is 35 to 45 percent clay.

Mitchell series

The Mitchell series consists of deep, well drained, moderately permeable soils on dissected plains and fans. These soils formed in calcareous loamy alluvium and colluvium. Slope is 0 to 9 percent.

These soils are coarse-silty, mixed (calcareous), mesic Ustic Torriorthents.

Typical pedon of a Mitchell silt loam in an area of Kim-Mitchell complex, 0 to 6 percent slopes, 2,640 feet south and 100 feet west of the northeast corner of sec. 22, T. 11 N., R. 65 W.

A11—0 to 4 inches; brown (10YR 5/3) silt loam, dark grayish brown (10YR 4/2) moist; weak medium platy structure; soft, very friable; strongly effervescent; moderately alkaline; abrupt smooth boundary.
A12—4 to 7 inches; pale brown (10YR 6/3) silt loam, brown (10YR 4/3) moist; weak medium and coarse subangular blocky structure; soft, very friable; strongly effervescent; moderately alkaline; abrupt smooth boundary.
AC—7 to 12 inches; very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) moist; weak medium and coarse subangular blocky structure; soft, very friable; 25 to 30 percent rounded soft siltstone fragments; violently effervescent; moderately alkaline; clear smooth boundary.
C1—12 to 21 inches; very pale brown (10YR 8/3) silt loam, light brownish gray (10YR 6/2) moist; massive; soft, very friable; violently effervescent; moderately alkaline; clear wavy boundary.
C2—21 to 60 inches; very pale brown (10YR 8/3) silt loam, pale brown (10YR 6/3) moist; massive; soft, very friable; violently effervescent; moderately alkaline.

Depth to free carbonates ranges from 0 to 6 inches. Content of soft coarse fragments, primarily rounded siltstone fragments, ranges from 0 to 30 percent but averages less than 15 percent. The control section commonly is silt loam, but in some pedons it is very fine sandy loam or loam that is less than 18 percent clay and less than 15 percent sand that is fine or coarser. It is mildly alkaline or moderately alkaline. The A horizon has value of 5 to 7 when dry and 4 or 5 when moist, and it

has chroma of 2 or 3. It is mildly alkaline or moderately alkaline.

Nucla series

The Nucla series consists of deep, well drained, moderately permeable soils on smooth to dissected plains. These soils formed in calcareous loamy alluvium. Slope is 0 to 9 percent.

These soils are fine-loamy, mixed, mesic Torriorthentic Haplustolls.

Typical pedon of Nucla loam, 3 to 9 percent slopes, 1,600 feet north and 2,350 feet east of the southwest corner of sec. 26, T. 11 N., R. 57 W.

A11—0 to 4 inches; brown (10YR 5/3) heavy loam, dark brown (10YR 3/3) moist; moderate fine granular structure; slightly hard, friable; neutral; clear smooth boundary.
A12—4 to 8 inches; brown (10YR 5/3) light clay loam, dark brown (10YR 3/3) moist; moderate coarse prismatic structure parting to moderate coarse subangular blocky; slightly hard, friable; slightly effervescent; mildly alkaline; clear wavy boundary.
B2—8 to 14 inches; pale brown (10YR 6/3) light clay loam, dark brown (10YR 4/3) moist; moderate coarse prismatic structure parting to moderate coarse subangular blocky; slightly hard, friable; strongly effervescent; moderately alkaline; clear wavy boundary.
Cca—14 to 60 inches; very pale brown (10YR 7/3) light clay loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, friable; violently effervescent; moderately alkaline.

Thickness of the solum ranges from 10 to 28 inches. Thickness of the mollic epipedon ranges from 7 to 19 inches. Depth to free carbonates ranges from 0 to 10 inches. The A horizon has value of 4 or 5 when dry and 2 or 3 when moist, and it has chroma of 1 to 3. The B horizon is 18 to 35 percent clay. It is mildly alkaline or moderately alkaline.

Nunn series

The Nunn series consists of deep, well drained, slowly permeable soils on dissected plains and stream terraces. These soils formed in calcareous loamy alluvium. Slope is 0 to 6 percent.

These soils are fine, montmorillonitic, mesic Aridic Argiustolls.

Typical pedon of Nunn loam, 0 to 6 percent slopes, about 1,400 feet west and 1,000 feet south of the northeast corner of sec. 17, T. 9 N., R. 63 W.

A11—0 to 3 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate very fine granular structure; soft, very friable; slightly acid; clear smooth boundary.
A12—3 to 7 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine to coarse granular structure; slightly hard, very friable; slightly acid; clear smooth boundary.
B21t—7 to 14 inches; grayish brown (10YR 5/2) heavy clay loam, very dark grayish brown (10YR 3/2) moist; strong medium prismatic structure parting to strong fine and medium angular blocky; hard, friable; neutral; gradual wavy boundary.
B22t—14 to 23 inches; light brownish gray (10YR 6/2) heavy clay loam, grayish brown (10YR 5/2) moist; moderate medium prismatic structure parting to moderate medium angular blocky; very hard, friable; mildly alkaline; gradual wavy boundary.
B3ca—23 to 31 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium and coarse angular blocky structure; hard, very friable; strongly effervescent; mildly alkaline; clear smooth boundary.
Cca—31 to 60 inches; dark grayish brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; massive; hard, very friable; common fine rounded seams of lime; strongly effervescent; mildly alkaline.

Thickness of the solum ranges from 16 to 45 inches. Depth to free carbonates ranges from 10 to 30 inches. Thickness of the mollic epipedon ranges from 7 to 18 inches. The A horizon has value of 4 or 5 when dry and 2 or 3 when moist, and it has chroma of 1 to 3. It is loam or clay loam. The B horizon commonly is heavy clay loam, but in some pedons it is light clay. It is neutral to moderately alkaline. The C horizon is mildly alkaline to strongly alkaline.

Olney series

The Olney series consists of deep, well drained, moderately permeable soils on smooth to dissected plains. These soils formed in calcareous loamy alluvium. Slope is 0 to 9 percent.

These soils are fine-loamy, mixed, mesic Ustollic Haplargids.

Typical pedon of Olney fine sandy loam, 0 to 6 percent slopes, 2,300 feet south and 1,575 feet east of the northwest corner of sec. 21, T. 8 N., R. 64 W.

A1—0 to 6 inches; brown (10YR 5/3) fine sandy loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; soft, very friable; neutral; clear smooth boundary.
B1—6 to 8 inches; brown (10YR 5/3) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; slightly hard, very friable; neutral; clear smooth boundary.
B21t—8 to 15 inches; yellowish brown (10YR 5/4) sandy clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate

coarse subangular blocky; very hard, friable; common moderately thick clay films on faces of peds; mildly alkaline; clear smooth boundary.
B22t—15 to 18 inches; brown (10YR 5/3) loam, brown (10YR 4/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; mildly alkaline; gradual irregular boundary.
B3ca—18 to 28 inches; light brownish gray (2.5Y 6/2) sandy loam, dark grayish brown (2.5Y 4/2) moist; weak coarse prismatic structure parting to weak coarse subangular blocky; hard, friable; strongly effervescent; mildly alkaline; gradual smooth boundary.
Cca—28 to 60 inches; light brownish gray (2.5Y 6/2) sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, very friable; strongly effervescent; moderately alkaline.

Thickness of the solum ranges from 15 to 30 inches. Depth to free carbonates ranges from 10 to 24 inches. The profile is 0 to 10 percent coarse fragments. The A horizon has value of 5 or 6 when dry and 4 or 5 when moist, and it has chroma of 2 or 3. It commonly is fine sandy loam, but in some pedons it is loamy sand. The B horizon is 18 to 30 percent clay.

Otero series

The Otero series consists of deep, well drained, moderately rapidly permeable soils on smooth to dissected plains, breaks, and alluvial and colluvial fans. These soils formed in calcareous loamy alluvium and colluvium. Slope is 0 to 25 percent.

These soils are coarse-loamy, mixed (calcareous), mesic Ustic Torriorthents.

Typical pedon of Otero sandy loam, 3 to 9 percent slopes, 1,800 feet south and 1,300 feet west of the northeast corner of sec. 5, T. 11 N., R. 64 W.

A1—0 to 5 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable; strongly effervescent; mildly alkaline; clear smooth boundary.
C1—5 to 17 inches; light yellowish brown (10YR 6/4) sandy loam, brown (10YR 4/3) moist; massive; soft, very friable; violently effervescent; moderately alkaline; clear smooth boundary.
C2—17 to 32 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 4/3) moist; massive; soft, very friable; violently effervescent; moderately alkaline; clear wavy boundary.
C3—32 to 60 inches; light yellowish brown (10YR 6/4) sandy loam, dark yellowish brown (10YR 4/4) moist; massive; soft, very friable; violently effervescent; moderately alkaline.

Depth to free carbonates ranges from 0 to 6 inches. Content of coarse fragments in the profile ranges from 0 to 15 percent but commonly is less than 10 percent. The control section commonly is sandy loam, but in some pedons it is fine sandy loam that has less than 18 percent clay and averages 50 to 82 percent sand. It is mildly alkaline or moderately alkaline. The A horizon has value of 5 to 7 when dry and 3 to 6 when moist, and it has chroma of 2 to 4.

Paoli series

The Paoli series consists of deep, well drained, moderately rapidly permeable soils on dissected alluvial and colluvial fans. These soils formed in calcareous loamy alluvium and colluvium. Slope is 0 to 9 percent.

These soils are coarse-loamy, mixed, mesic Pachic Haplustolls.

Typical pedon of Paoli fine sandy loam, 0 to 6 percent slopes, 1,000 feet south and 850 feet west of the northeast corner of sec. 15, T. 11 N., R. 63 W.

A11—0 to 8 inches; brown (10YR 4/3) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable; neutral; clear smooth boundary.
A12—8 to 10 inches; brown (10YR 4/3) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; soft, very friable; slightly effervescent; mildly alkaline; clear smooth boundary.
A13—10 to 15 inches; brown (10YR 4/3) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to weak fine subangular blocky; soft, very friable; strongly effervescent; mildly alkaline; clear smooth boundary.
A14—15 to 27 inches; brown (10YR 5/3) coarse sandy loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; soft, very friable; strongly effervescent; mildly alkaline; gradual wavy boundary.
C1ca—27 to 45 inches; brown (10YR 5/3) coarse sandy loam, brown (10YR 4/3) moist; massive; soft, very friable; 10 percent coarse fragments; strongly effervescent; moderately alkaline; clear smooth boundary.
C2ca—45 to 60 inches; pale brown (10YR 6/3) sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; 10 to 15 percent coarse fragments; few fine irregularly shaped seams of lime; violently effervescent; moderately alkaline.

Thickness of the mollic epipedon ranges from 20 to 40 inches. Depth to free carbonates ranges from 5 to 25 inches. Content of coarse fragments in the profile ranges from 0 to 15 percent but commonly is less than 10 percent. The control section commonly is sandy loam, but in some pedons it is fine sandy loam that is less than 18 percent clay. It is mildly alkaline or moderately alkaline. The A horizon has value of 4 or 5 when dry and

2 or 3 when moist, and it has chroma of 1 to 3. It is neutral or mildly alkaline.

Peetz series

The Peetz series consists of deep, somewhat excessively drained, rapidly permeable soils on dissected upland ridges, breaks, and escarpments. These soils formed in calcareous gravelly alluvium. Slope is 0 to 40 percent.

These soils are sandy-skeletal, mixed, mesic Aridic Calciustolls.

Typical pedon of Peetz gravelly sandy loam, 5 to 20 percent slopes, 600 feet west and 2,540 feet north of the southeast corner of sec. 6, T. 11 N., R. 62 W.

A11—0 to 4 inches; grayish brown (10YR 5/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; soft, very friable; 20 percent gravel; mildly alkaline; clear smooth boundary.

A12—4 to 8 inches; brown (10YR 5/3) very gravelly loamy sand, dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable; 35 percent gravel; mildly alkaline; clear smooth boundary.

Cca—8 to 20 inches; pale brown (10YR 6/3) very gravelly sand, brown (10YR 4/3) moist; single grain; loose; 40 percent gravel; common fine rounded soft masses and concretions of lime; violently effervescent; moderately alkaline; clear smooth boundary.

C2—20 to 36 inches; very pale brown (10YR 7/3) very gravelly sand, pale brown (10YR 6/3) moist; single grain; loose; 40 percent gravel; strongly effervescent; moderately alkaline; clear smooth boundary.

C3—36 to 60 inches; very pale brown (10YR 7/4) gravelly sand, light yellowish brown (10YR 6/4) moist; single grain; loose; 30 percent gravel; strongly effervescent; moderately alkaline.

Thickness of the mollic epipedon ranges from 7 to 15 inches. Depth to free carbonates ranges from 0 to 15 inches. The control section is 35 to 65 percent coarse fragments. It commonly is very gravelly sand, but in some pedons it is very gravelly loamy sand. The control section is mildly alkaline or moderately alkaline. The A horizon is 15 to 35 percent coarse fragments. It has value of 4 or 5 when dry and 2 or 3 when moist, and it has chroma of 1 to 3.

Platner series

The Platner series consists of deep, well drained, slowly permeable soils on smooth to dissected plains and adjacent stream terraces. These soils formed in calcareous loamy alluvium. Slope is 0 to 3 percent.

These soils are fine, montmorillonitic, mesic Aridic Paleustolls.

Typical pedon of Platner loam, 0 to 3 percent slopes, 120 feet south and 100 feet east of the northwest corner of sec. 33, T. 9 N., R. 56 W.

Ap—0 to 4 inches; grayish brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, friable; neutral; abrupt smooth boundary.

B21t—4 to 10 inches; brown (10YR 5/3) heavy clay loam, dark brown (10YR 3/3) moist; strong medium prismatic structure parting to strong medium angular blocky; hard, firm; common moderately thick clay films on faces of peds; mildly alkaline; clear smooth boundary.

B22t—10 to 17 inches; pale brown (10YR 6/3) clay, dark brown (10YR 4/3) moist; strong medium prismatic structure parting to strong medium angular blocky; hard, firm; common moderately thick clay films on faces of peds; mildly alkaline; clear smooth boundary.

B3ca—17 to 24 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, friable; common fine rounded masses of segregated lime in seams; strongly effervescent; moderately alkaline; clear smooth boundary.

C1ca—24 to 38 inches; very pale brown (10YR 7/3) fine sandy loam, pale brown (10YR 6/3) moist; massive; soft, very friable; disseminated lime; violently effervescent; moderately alkaline; gradual wavy boundary.

C2—38 to 54 inches; very pale brown (10YR 7/4) fine sandy loam, yellowish brown (10YR 5/4) moist; massive; soft, very friable; disseminated lime; strongly effervescent; moderately alkaline; gradual wavy boundary.

C3—54 to 60 inches; very pale brown (10YR 7/3) sandy loam, yellowish brown (10YR 5/4) moist; massive; soft, very friable; disseminated lime; strongly effervescent; moderately alkaline.

Thickness of the solum ranges from 15 to 35 inches. Thickness of the mollic epipedon ranges from 7 to 15 inches. Depth to free carbonates ranges from 8 to 24 inches. The profile is 0 to 15 percent coarse fragments. The A horizon has value of 4 or 5 when dry and 2 or 3 when moist, and it has chroma of 2 or 3.

Renohill series

The Renohill series consists of moderately deep, well drained, slowly permeable soils on dissected plains and upland ridges. These soils formed in calcareous loamy and clayey residuum derived from shale. Slope is 0 to 9 percent.

These soils are fine, montmorillonitic, mesic Ustollic Haplargids.

Typical pedon of Renohill fine sandy loam, 0 to 6 percent slopes, 650 feet north and 1,400 feet east of the southwest corner of sec. 15, T. 8 N., R. 64 W.

A1—0 to 5 inches; brown (10YR 5/3) fine sandy loam, very dark brown (10YR 4/2) moist; moderate fine granular structure; slightly hard, very friable; neutral; clear smooth boundary.
B2t—5 to 13 inches; olive brown (2.5Y 5/4) heavy clay loam, grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; very hard, friable; many moderately thick clay films on faces of peds; mildly alkaline; gradual smooth boundary.
B3ca—13 to 18 inches; light olive brown (2.5Y 5/4) heavy clay loam, dark grayish brown (2.5Y 4/2) moist; moderate medium prismatic structure parting to moderate fine subangular blocky; very hard, very friable; few fine irregularly shaped soft masses of lime; strongly effervescent; moderately alkaline; gradual wavy boundary.
C1ca—18 to 32 inches; grayish brown (2.5Y 5/2) light clay loam, dark grayish brown (2.5Y 4/2) moist; massive; hard, friable; common medium irregularly shaped soft masses and seams of lime; strongly effervescent; moderately alkaline; gradual irregular boundary.
C2r—32 inches; calcareous shale and sandstone.

Thickness of the solum ranges from 17 to 30 inches. Depth to free carbonates ranges from 8 to 15 inches. Depth to shale ranges from 20 to 40 inches. The A horizon has value of 5 or 6 when dry and 4 or 5 when moist, and it has chroma of 2 or 3. The B horizon commonly is heavy clay loam, but in some pedons it is light clay. It is 35 to 45 percent clay. The B horizon is neutral to moderately alkaline. The C horizon is moderately alkaline or strongly alkaline.

Rosebud series

The Rosebud series consists of moderately deep, well drained, moderately permeable soils on dissected high plains. These soils formed in calcareous loamy residuum derived from soft sandstone. Slope is 0 to 9 percent.

These soils are fine-loamy, mixed, mesic Aridic Argiustolls.

Typical pedon of Rosebud fine sandy loam, 0 to 6 percent slopes, 2,400 feet west and 2,200 feet north of the southeast corner of sec. 19, T. 12 N., R. 59 W.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine crumb structure; slightly hard, very friable; neutral; clear smooth boundary.
B21t—5 to 10 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, very firm; common moderately thick clay films on faces of peds; neutral; clear smooth boundary.
B22t—10 to 15 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure parting to weak fine subangular blocky; very hard, very firm; thin clay films on faces of peds; slightly effervescent; mildly alkaline; clear smooth boundary.
B3ca—15 to 19 inches; pale brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; weak medium subangular blocky structure parting to weak fine subangular blocky; hard, firm; disseminated lime; strongly effervescent; moderately alkaline; gradual smooth boundary.
C1ca—19 to 24 inches; very pale brown (10YR 7/3) sandy clay loam, pale brown (10YR 6/3) moist; massive; slightly hard, friable; disseminated lime; violently effervescent; moderately alkaline; clear smooth boundary.
C2ca—24 to 38 inches; very pale brown (10YR 7/4) sandy loam, light yellowish brown (10YR 6/4) moist; massive; soft, very friable; disseminated lime; discontinuous lenses of hard horizontal caliche material; violently effervescent; moderately alkaline; abrupt smooth boundary.
C3r—38 inches; indurated calcareous sandstone.

Thickness of the solum ranges from 12 to 24 inches. Thickness of the mollic epipedon ranges from 7 to 12 inches. Depth to free carbonates ranges from 12 to 18 inches. Depth to sandstone ranges from 20 to 40 inches. The A horizon has value of 4 or 5 when dry and 2 or 3 when moist, and it has chroma of 2 or 3. The B horizon commonly is clay loam, but in some pedons it is loam. It is neutral or mildly alkaline.

Shingle series

The Shingle series consists of shallow, well drained, moderately permeable soils on dissected plains, upland ridges, and breaks. These soils formed in calcareous loamy and clayey residuum derived from shale. Slope is 0 to 30 percent.

These soils are loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents.

Typical pedon of Shingle clay loam, 0 to 9 percent slopes, 650 feet north and 2,515 feet east of the southwest corner of sec. 14, T. 10 N., R. 64 W.

A1—0 to 4 inches; yellowish brown (10YR 5/4) clay loam, brown (7.5YR 5/4) moist; very fine and fine granular structure; soft, very friable; slightly effervescent; mildly alkaline; gradual irregular boundary.
C1—4 to 11 inches; light yellowish brown (10YR 6/4) clay loam, brown (7.5YR 5/4) moist; massive; very hard, friable; slightly effervescent; moderately alkaline; gradual irregular boundary.

C2r—11 inches; variegated, calcareous clayey shale.

Depth to free carbonates ranges from 0 to 3 inches. The profile is 0 to 15 percent coarse fragments. Depth to shale ranges from 10 to 20 inches. The control section commonly is clay loam, but in some pedons it is loam or sandy clay loam. It is less than 35 percent clay and is 15 to 55 percent sand. The A horizon has value of 5 to 7 when dry and 3 to 6 when moist, and it has chroma of 1 to 4. It is mildly alkaline to strongly alkaline. The C horizon is moderately alkaline or strongly alkaline.

Stoneham series

The Stoneham series consists of deep, well drained, moderately permeable soils on smooth to dissected high plains and alluvial fans. These soils formed in calcareous loamy alluvium. Slope is 0 to 9 percent.

These soils are fine-loamy, mixed, mesic Ustollic Haplargids.

Typical pedon of Stoneham fine sandy loam, 6 to 9 percent slopes, 700 feet west and 1,800 feet south of the northeast corner of sec. 20, T. 8 N., R. 60 W.

A1—0 to 5 inches; pale brown (10YR 6/3) fine sandy loam, dark brown (10YR 3/3) moist; moderate medium crumb structure; slightly hard, very friable; neutral; abrupt smooth boundary.

B2t—5 to 8 inches; brown (10YR 5/3) light clay loam, brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate fine angular blocky; very hard, friable; common thin clay films on faces of peds; mildly alkaline; clear smooth boundary.

B3ca—8 to 14 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak medium prismatic structure parting to weak medium subangular blocky; very hard, friable; few thin clay films on faces of peds; strongly effervescent; mildly alkaline; gradual irregular boundary.

C1ca—14 to 20 inches; very pale brown (10YR 7/3) sandy loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; very hard, very friable; many fine irregularly shaped threads and soft masses of lime; violently effervescent; moderately alkaline; gradual smooth boundary.

C2ca—20 to 31 inches; very pale brown (10YR 7/3) sandy loam, light yellowish brown (10YR 6/4) moist; massive; slightly hard, very friable; common fine irregularly shaped threads of lime; violently effervescent; moderately alkaline; gradual smooth boundary.

C3—31 to 60 inches; very pale brown (10YR 7/3) sandy loam, yellowish brown (10YR 5/4) moist; massive; soft, very friable; strongly effervescent; moderately alkaline.

Thickness of the solum ranges from 10 to 15 inches. Depth to free carbonates ranges from 3 to 10 inches. The A horizon has value of 5 or 6 when dry and 3 or 4 when moist, and it has chroma of 2 or 3. The B horizon commonly is clay loam, but in some pedons it is heavy loam, sandy clay loam, or heavy sandy loam. It is 18 to 35 percent clay and is 20 to 70 percent sand. The B horizon is neutral or mildly alkaline. The C horizon is 0 to 10 percent coarse fragments, but typically it is less than 5 percent. It is moderately alkaline or strongly alkaline.

Tassel series

The Tassel series consists of shallow, well drained, moderately rapidly permeable soils on dissected plains and breaks. These soils formed in calcareous loamy residuum derived from sandstone. Slope is 5 to 30 percent.

These soils are loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents.

Typical pedon of a Tassel loamy fine sand in an area of Otero-Tassel complex, 6 to 30 percent slopes, 950 feet north and 1,900 feet west of the southeast corner of sec. 22, T. 8 N., R. 58 W.

A1—0 to 7 inches; light yellowish brown (2.5Y 6/4) loamy fine sand, olive brown (2.5Y 4/4) moist; weak fine granular structure; soft, very friable; mildly alkaline; clear wavy boundary.

C1—7 to 19 inches; light yellowish brown (2.5Y 6/4) fine sandy loam, olive brown (2.5Y 4/4) moist; massive; slightly hard, very friable; strongly effervescent; moderately alkaline; clear smooth boundary.

C2r—19 inches; calcareous sandstone.

These soils commonly have free carbonates at the surface. Depth to sandstone ranges from 10 to 20 inches. Content of rock fragments in the profile ranges from 5 to 30 percent. The A horizon has value of 5 to 7 when dry and 4 or 5 when moist, and it has chroma of 2 to 4.

Terry series

The Terry series consists of moderately deep, well drained, moderately rapidly permeable soils on smooth to dissected plains. These soils formed in calcareous sandy residuum derived from sandstone. Slope is 0 to 9 percent.

These soils are coarse-loamy, mixed, mesic Ustollic Haplargids.

Typical pedon of Terry sandy loam, 3 to 9 percent slopes, 500 feet east and 1,200 feet south of the northwest corner of sec. 20, T. 8 N., R. 59 W.

A1—0 to 5 inches; grayish brown (10YR 5/2) sandy loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; soft, very friable; mildly alkaline; clear smooth boundary.

B2t—5 to 17 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure; slightly hard, very friable; very few thin clay films on faces of peds and lining interstitial pores; mildly alkaline; clear smooth boundary.
C1ca—17 to 32 inches; light olive brown (2.5Y 5/4) loamy sand, olive brown (2.5Y 4/4) moist; single grain; loose; strongly effervescent; moderately alkaline; clear wavy boundary.
C2r—32 inches; calcareous sandstone.

Thickness of the solum ranges from 15 to 29 inches. Depth to free carbonates ranges from 12 to 20 inches. The profile is 0 to 15 percent coarse fragments. Depth to sandstone ranges from 20 to 40 inches. The A horizon has value of 5 to 7 when dry and 3 or 4 when moist, and it has chroma of 1 to 3. The B horizon commonly is 9 to 18 percent clay. It is neutral or mildly alkaline. The C horizon is moderately alkaline or strongly alkaline.

Thedalund series

The Thedalund series consists of moderately deep, well drained, moderately permeable soils on fans, upland ridges, and plains. These soils formed in calcareous loamy residuum derived from fine-grained sandstone, shale, and siltstone. Slope is 0 to 9 percent.

These soils are fine-loamy, mixed (calcareous), mesic Ustic Torriorthents.

Typical pedon of a Thedalund loam in an area of Thedalund-Keota loams, 3 to 9 percent slopes, about 600 feet north and 2,340 feet west of the southeast corner of sec. 15, T. 15 N., R. 61 W.

A1—0 to 3 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; soft, very friable; slightly effervescent; mildly alkaline; clear smooth boundary.
AC—3 to 13 inches; brown (10YR 5/3) loam, grayish brown (10YR 5/2) moist; weak coarse angular blocky structure; slightly hard, friable; strongly effervescent; moderately alkaline; gradual smooth boundary.
C1—13 to 25 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; weak fine and medium subangular blocky structure; slightly hard, friable; violently effervescent; moderately alkaline; abrupt smooth boundary.
C2r—25 inches; calcareous siltstone.

Depth to free carbonates ranges from 0 to 4 inches. Content of siltstone fragments in the profile ranges from 0 to 15 percent but commonly is less than 10 percent. Depth to bedrock ranges from 20 to 40 inches. The control section commonly is loam, but in some pedons it is very fine sandy loam or light clay loam. It is 18 to 35 percent clay and 15 to 45 percent sand that is fine or coarser. The A horizon has value of 5 to 7 when dry and 3 to 5 when moist, and it has chroma of 2 to 4. It is mildly alkaline or moderately alkaline.

Treon series

The Treon series consists of shallow, well drained, moderately rapidly permeable soils on dissected plains, upland ridges, and escarpments. These soils formed in calcareous loamy residuum derived from sandstone. Slope is 5 to 20 percent.

These soils are loamy, mixed, mesic, shallow Torriorthentic Haplustolls.

Typical pedon of Treon fine sandy loam, 5 to 20 percent slopes, 1,800 feet west and 600 feet south of the northeast corner of sec. 35, T. 12 N., R. 64 W.

A1—0 to 7 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; moderate fine and medium granular structure; soft, very friable; strongly effervescent; mildly alkaline; clear smooth boundary.
C1ca—7 to 11 inches; very pale brown (10YR 7/3) fine sandy loam, dark brown (10YR 3/3) moist; massive; slightly hard, very friable; disseminated lime; violently effervescent; mildly alkaline; abrupt smooth boundary.
C2r—11 inches; calcareous fine-grained sandstone.

Thickness of the mollic epipedon ranges from 7 to 12 inches. Depth to free carbonates ranges from 0 to 4 inches. The profile is 0 to 10 percent coarse fragments. Depth to sandstone ranges from 10 to 20 inches. The A horizon has value of 4 or 5 when dry and 2 or 3 when moist, and it has chroma of 2 or 3. It is neutral to moderately alkaline. The C horizon commonly is fine sandy loam, but in some pedons it is sandy loam. It is mildly alkaline or moderately alkaline.

Vona series

The Vona series consists of deep, well drained and somewhat excessively drained, moderately rapidly permeable soils on smooth to dissected plains. These soils formed in calcareous sandy alluvial or eolian material. Slope is 0 to 9 percent.

These soils are coarse-loamy, mixed, mesic Ustollic Haplargids.

Typical pedon of Vona sandy loam, 3 to 9 percent slopes, about 1,000 feet west and 5 feet north of the southeast corner of sec. 19, T. 10 N., R. 64 W.

A1—0 to 6 inches; brown (10YR 5/3) sandy loam, brown (10YR 4/3) moist; weak medium granular structure; soft, very friable; mildly alkaline; clear smooth boundary.
B2t—6 to 10 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure; slightly hard, very friable; mildly alkaline; clear smooth boundary.

B3—10 to 15 inches; yellowish brown (10YR 5/4) coarse sandy loam, brown (10YR 5/3) moist; weak coarse prismatic structure; soft, very friable; mildly alkaline; gradual wavy boundary.
C1—15 to 30 inches; light yellowish brown (10YR 6/4) loamy sand, yellowish brown (10YR 5/4) moist; massive; soft, very friable; strongly effervescent; moderately alkaline; clear smooth boundary.
C2ca—30 to 60 inches; very pale brown (10YR 7/4) loamy sand, yellowish brown (10YR 5/4) moist; massive; soft, very friable; common fine irregularly shaped seams and soft masses of lime; strongly effervescent; moderately alkaline.

Thickness of the solum ranges from 15 to 35 inches. Depth to free carbonates ranges from 8 to 24 inches. The A horizon has value of 5 or 6 when dry and 3 to 5 when moist, and it has chroma of 2 or 3. It is sandy loam or loamy sand. The B horizon commonly is sandy loam, but in some pedons it is fine sandy loam. It is neutral or mildly alkaline. The C horizon is moderately alkaline or strongly alkaline.

Wages series

The Wages series consists of deep, well drained, moderately permeable soils on dissected plains and alluvial fans. These soils formed in calcareous loamy alluvium. Slope is 0 to 9 percent.

These soils are fine-loamy, mixed, mesic Aridic Argiustolls.

Typical pedon of Wages fine sandy loam, 6 to 9 percent slopes, 220 feet west and 700 feet north of the southeast corner of sec. 34, T. 11 N., R. 65 W.

A1—0 to 4 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; slightly hard, very friable; neutral; abrupt smooth boundary.
B2t—4 to 14 inches; grayish brown (10YR 5/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to moderate medium and coarse subangular blocky; hard, firm; many thin clay films on faces of peds; mildly alkaline; abrupt wavy boundary.
C1ca—14 to 29 inches; very pale brown (10YR 7/3) light loam, brown (10YR 5/3) moist; weak medium subangular blocky structure; slightly hard, friable; violently effervescent; moderately alkaline; gradual wavy boundary.
C2ca—29 to 60 inches; very pale brown (10YR 7/4) loam, yellowish brown (10YR 5/4) moist; massive; soft, very friable; common fine slightly oblong seams of lime; violently effervescent; moderately alkaline.

Thickness of the solum ranges from 12 to 15 inches. Thickness of the mollic epipedon ranges from 7 to 15 inches. Depth to free carbonates ranges from 10 to 14 inches. The A horizon has value of 4 or 5 when dry and 2 or 3 when moist, and it has chroma of 2 or 3. The B horizon commonly is sandy clay loam, but in some pedons it is light clay loam or loam. It is 18 to 35 percent clay and is 20 to 65 percent sand. The B horizon is neutral or mildly alkaline. The C horizon is moderately alkaline or strongly alkaline.

Weld series

The Weld series consists of deep, well drained, slowly permeable soils on smooth plains. These soils formed in calcareous, loamy eolian material. Slope is 0 to 6 percent.

These soils are fine, montmorillonitic, mesic Aridic Paleustolls.

Typical pedon of Weld loam, 0 to 6 percent slopes, 300 feet west and 500 feet south of the northeast corner of sec. 23, T. 8 N., R. 56 W.

A1—0 to 7 inches; brown (10YR 5/3) loam, very dark grayish brown (10YR 3/2) moist; weak medium prismatic structure parting to weak medium and coarse subangular blocky; slightly hard, very friable; neutral; clear smooth boundary.
A2—7 to 9 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak fine and medium prismatic structure parting to weak fine and medium subangular blocky; slightly hard, very friable; neutral; abrupt smooth boundary.
B21t—9 to 14 inches; yellowish brown (10YR 5/4) clay, brown (10YR 4/3) moist; strong fine and medium prismatic structure parting to strong fine and medium angular blocky; hard, firm, sticky and plastic; common moderately thick clay films on faces of peds; neutral; clear smooth boundary.
B22t—14 to 18 inches; yellowish brown (10YR 5/4) heavy clay loam, brown (10YR 4/3) moist; strong fine and medium angular blocky structure; hard, firm, sticky and plastic; few thin clay films on faces of peds; neutral; clear smooth boundary.
B3ca—18 to 22 inches; pale brown (10YR 6/3) silty clay loam, brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; hard, friable, sticky and plastic; strongly effervescent; strongly alkaline; clear smooth boundary.
C1ca—22 to 28 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; violently effervescent; strongly alkaline; clear smooth boundary.
C2ca—28 to 60 inches; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; massive; soft, very friable; violently effervescent; strongly alkaline.

Thickness of the solum ranges from 18 to 34 inches. Thickness of the mollic epipedon ranges from 7 to 14

inches. Depth to free carbonates ranges from 13 to 20 inches. The A horizon has value of 4 or 5 when dry and 2 or 3 when moist, and it has chroma of 2 or 3. The B2t horizon commonly is light clay or heavy clay loam and is 35 to 45 percent clay. The C horizon is moderately alkaline or strongly alkaline.

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(4) United States Department of Agriculture. 1961. Land capability classification. U.S. Dep. Agric. Handb. 210, 21 pp.

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glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Badland. Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in

diameter; if flat, mineral or rock particles (flagstone) 15.2 to 38.1 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or arresting grazing for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops

unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess alkali (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, and clay.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 37.5 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Fragile (in tables). A soil that is easily damaged by use or disturbance.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a

rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use. Grazing at an intensity that maintains enough cover to protect the soil and to maintain or improve the quantity and quality of desirable vegetation.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to insure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium absorption ratio (SAR) of a saturation extract, or the ratio of Na^+ to $Ca^{++} + Mg^{++}$. The degrees of sodicity are—

	SAR
Slight	Less than 13:1
Moderate	13-30:1
Strong	More than 30:1

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

tables

TABLE 1.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Altvan fine sandy loam, 0 to 6 percent slopes	42,939	3.0
2	Altvan fine sandy loam, 6 to 9 percent slopes	4,412	0.3
3	Argiustolls-Rock outcrop complex, 0 to 9 percent slopes	2,532	0.2
4	Ascalon fine sandy loam, 0 to 6 percent slopes	195,887	13.8
5	Ascalon fine sandy loam, 6 to 9 percent slopes	68,193	4.8
6	Ascalon-Blakeland complex, 3 to 15 percent slopes	5,110	0.4
7	Ascalon-Bushman-Curabith complex, 0 to 3 percent slopes	1,332	0.1
8	Ascalon-Bushman-Curabith complex, 3 to 15 percent slopes	11,689	0.8
9	Avar fine sandy loam	22,655	1.6
10	Avar-Manzanola complex, 0 to 3 percent slopes	5,381	0.4
11	Badland	7,322	0.5
12	Bankard loamy fine sand, 0 to 3 percent slopes	7,716	0.5
13	Blakeland loamy sand, 0 to 6 percent slopes	1,005	0.1
14	Blakeland loamy sand, 6 to 12 percent slopes	1,998	0.1
15	Bresser sandy loam, 0 to 3 percent slopes	2,406	0.2
16	Bresser sandy loam, 3 to 9 percent slopes	1,830	0.1
17	Bushman fine sandy loam, 0 to 3 percent slopes	4,505	0.3
18	Bushman fine sandy loam, 3 to 9 percent slopes	13,258	0.9
19	Bushman-Curabith-Canyon complex, 0 to 20 percent slopes	16,029	1.1
20	Cascajo gravelly sandy loam, 5 to 20 percent slopes	20,876	1.5
21	Cushman fine sandy loam, 0 to 6 percent slopes	664	*
22	Cushman fine sandy loam, 6 to 9 percent slopes	3,205	0.2
23	Dacono clay loam, 0 to 6 percent slopes	9,257	0.6
24	Eckley sandy clay loam, 0 to 6 percent slopes	1,364	0.1
25	Eckley sandy clay loam, 6 to 9 percent slopes	1,535	0.1
26	Eckley-Dix-Blakeland complex, 6 to 20 percent slopes	10,559	0.7
27	Epping silt loam, 0 to 9 percent slopes	37,172	2.6
28	Haplaquolls-Fluvaquents complex, frequently flooded	1,491	0.1
29	Haverson loam, 0 to 3 percent slopes	34,780	2.4
30	Keith loam, 0 to 6 percent slopes	7,075	0.5
31	Kim-Mitchell complex, 0 to 6 percent slopes	64,150	4.5
32	Kim-Mitchell complex, 6 to 9 percent slopes	22,796	1.6
33	Kim-Shingle complex, 6 to 30 percent slopes	12,515	0.9
34	Manter sandy loam, 0 to 6 percent slopes	3,424	0.2
35	Manter sandy loam, 6 to 9 percent slopes	3,776	0.3
36	Manzanola clay loam, 0 to 3 percent slopes	15,267	1.1
37	Midway clay loam, 0 to 9 percent slopes	4,589	0.3
38	Nucla loam, 0 to 3 percent slopes	3,894	0.3
39	Nucla loam, 3 to 9 percent slopes	643	*
40	Nunn loam, 0 to 6 percent slopes	50,113	3.5
41	Nunn clay loam, 0 to 6 percent slopes	22,355	1.6
42	Olney loamy sand, 0 to 3 percent slopes	1,940	0.1
43	Olney loamy sand, 3 to 9 percent slopes	556	*
44	Olney fine sandy loam, 0 to 6 percent slopes	143,897	10.1
45	Olney fine sandy loam, 6 to 9 percent slopes	47,540	3.3
46	Otero sandy loam, 0 to 3 percent slopes	7,172	0.5
47	Otero sandy loam, 3 to 9 percent slopes	14,778	1.0
48	Otero-Tassel complex, 6 to 30 percent slopes	15,697	1.1
49	Paoli fine sandy loam, 0 to 6 percent slopes	5,537	0.4
50	Paoli fine sandy loam, 6 to 9 percent slopes	2,788	0.2
51	Peetz gravelly sandy loam, 5 to 20 percent slopes	25,924	1.8
52	Peetz-Altvan complex, 0 to 20 percent slopes	5,791	0.4
53	Peetz-Rock outcrop complex, 9 to 40 percent slopes	10,326	0.7
54	Platner loam, 0 to 3 percent slopes	98,774	6.9
55	Renohill fine sandy loam, 0 to 6 percent slopes	39,279	2.7
56	Renohill fine sandy loam, 6 to 9 percent slopes	29,229	2.0
57	Renohill-Shingle complex, 3 to 9 percent slopes	46,342	3.2
58	Rosebud fine sandy loam, 0 to 6 percent slopes	6,813	0.5
59	Rosebud fine sandy loam, 6 to 9 percent slopes	3,740	0.3
60	Shingle clay loam, 0 to 9 percent slopes	7,398	0.5
61	Stoneham fine sandy loam, 0 to 6 percent slopes	20,921	1.5
62	Stoneham fine sandy loam, 6 to 9 percent slopes	16,580	1.2
63	Tassel loamy fine sand, 5 to 20 percent slopes	9,175	0.6
64	Terry sandy loam, 0 to 3 percent slopes	2,222	0.2
65	Terry sandy loam, 3 to 9 percent slopes	23,851	1.7
66	Thedalund-Keota loams, 0 to 3 percent slopes	1,823	0.1
67	Thedalund-Keota loams, 3 to 9 percent slopes	4,467	0.3

See footnote at end of table.

TABLE 1.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
68	Treon fine sandy loam, 5 to 20 percent slopes	757	0.1
69	Treon-Rock outcrop complex, 9 to 40 percent slopes	3,724	0.3
70	Ustic Torriorthents-Rock outcrop complex, 9 to 40 percent slopes	9,373	0.7
71	Vona loamy sand, 0 to 3 percent slopes	2,560	0.2
72	Vona loamy sand, 3 to 9 percent slopes	12,478	0.9
73	Vona sandy loam, 0 to 3 percent slopes	10,403	0.7
74	Vona sandy loam, 3 to 9 percent slopes	19,242	1.3
75	Wages fine sandy loam, 0 to 6 percent slopes	11,247	0.8
76	Wages fine sandy loam, 6 to 9 percent slopes	7,012	0.5
77	Weld loam, 0 to 6 percent slopes	11,406	0.8
	Water	1,059	0.1
	Total	1,429,520	100.0

* Less than 0.1 percent.

TABLE 2.--YIELDS PER ACRE OF NONIRRIGATED CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil. Only the soils suited to nonirrigated crops and pasture are listed]

Soil name and map symbol	Wheat	Barley	Annual hay crops
	Bu	Bu	Ton
1---------- Altvan	26	30	1.5
4---------- Ascalon	26	30	1.5
7---------- Ascalon-Bushman-Curabith	25	28	1.25
15---------- Bresser	25	30	1.5
17---------- Bushman	20	24	1.25
21---------- Cushman	18	---	0.75
23---------- Dacono	25	30	1.5
24---------- Eckley	18	20	0.5
29---------- Haverson	22	27	1.5
30---------- Keith	25	30	1.5
31---------- Kim-Mitchell	18	---	0.5
34---------- Manter	25	30	1.5
36---------- Manzanola	18	---	0.5
38---------- Nucla	20	---	1.0
40, 41---------- Nunn	30	35	1.5
42---------- Olney	24	28	1.25
44---------- Olney	26	30	1.5
46---------- Otero	17	---	0.5
49---------- Paoli	21	25	0.75
54---------- Platner	30	35	1.5
55---------- Renohill	25	30	0.75

TABLE 2.--YIELDS PER ACRE OF NONIRRIGATED CROPS AND PASTURE--Continued

Soil name and map symbol	Wheat	Barley	Annual hay crops
	Bu	Bu	Ton
58---------- Rosebud	30	35	1.5
61---------- Stoneham	18	20	0.5
64---------- Terry	22	26	0.75
66---------- Thedalund-Keota	18	18	0.5
71---------- Vona	13	13	---
73---------- Vona	18	23	0.5
75---------- Wages	20	25	1.0
77---------- Weld	30	35	1.5

TABLE 3.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
1 Altvan	Slight	Slight	Moderate: slope.	Slight.
2 Altvan	Slight	Slight	Severe: slope.	Slight.
3*: Argiustolls. Rock outcrop.				
4 Ascalon	Slight	Slight	Moderate: slope.	Slight.
5 Ascalon	Slight	Slight	Severe: slope.	Slight.
6*: Ascalon	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Blakeland	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
7*: Ascalon	Slight	Slight	Slight	Slight.
Bushman	Slight	Slight	Moderate: small stones.	Slight.
Curabith	Slight	Slight	Slight	Slight.
8*: Ascalon	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Bushman	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Curabith	Moderate: slope.	Moderate: slope.	Severe slope.	Slight.
9 Avar	Severe: flooding, percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight.
10*: Avar	Severe: flooding, percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight.
Manzanola	Slight	Slight	Moderate: small stones.	Slight.
11*. Badland				
12 Bankard	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.
13 Blakeland	Slight	Slight	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 3.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
14--Blakeland	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
15--Bresser	Slight	Slight	Moderate: small stones.	Slight.
16--Bresser	Slight	Slight	Severe: slope.	Slight.
17--Bushman	Slight	Slight	Moderate: small stones.	Slight.
18--Bushman	Slight	Slight	Severe: slope.	Slight.
19*:				
Bushman	Slight	Slight	Moderate: slope, small stones.	Slight.
Curabith	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Canyon	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: dusty.
20--Cascajo	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight.
21--Cushman	Slight	Slight	Moderate: slope, small stones, depth to rock.	Severe: erodes easily.
22--Cushman	Slight	Slight	Severe: slope.	Severe: erodes easily.
23--Dacono	Slight	Slight	Moderate: slope, small stones.	Slight.
24--Eckley	Slight	Slight	Moderate: slope.	Slight.
25--Eckley	Slight	Slight	Severe: slope.	Slight.
26*:				
Eckley	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Dix	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight.
Blakeland	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
27--Epping	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight.
28*:				
Haplaquolls.				
Fluvaquents.				

See footnote at end of table.

TABLE 3.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
29--Haverson	Severe: flooding.	Moderate: dusty.	Moderate: small stones.	Moderate: dusty.
30--Keith	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
31*:				
Kim	Moderate: dusty.	Moderate: dusty.	Moderate: slope, small stones, dusty.	Moderate: dusty.
Mitchell	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.
32*:				
Kim	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
Mitchell	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
33*:				
Kim	Moderate: slope, dusty.	Moderate: slope, dusty.	Severe: slope.	Moderate: dusty.
Shingle	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones, depth to rock.	Moderate: slope.
34--Manter	Slight	Slight	Moderate: slope, small stones.	Slight.
35--Manter	Slight	Slight	Severe: slope.	Slight.
36--Manzanola	Slight	Slight	Moderate: small stones.	Slight.
37--Midway	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight.
38--Nucla	Moderate: dusty.	Moderate: dusty.	Moderate: small stones, dusty.	Moderate: dusty.
39--Nucla	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
40--Nunn	Moderate: dusty.	Moderate: dusty.	Moderate: small stones, slope.	Moderate: dusty.
41--Nunn	Slight	Slight	Moderate: small stones, slope.	Slight.
42--Olney	Slight	Slight	Slight	Slight.
43--Olney	Slight	Slight	Severe: slope.	Slight.

See footnote at end of table.

TABLE 3.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
44---------- Olney	Slight----------	Slight----------	Moderate: slope.	Slight.
45---------- Olney	Slight----------	Slight----------	Severe: slope.	Slight.
46---------- Otero	Slight----------	Slight----------	Moderate: small stones.	Slight.
47---------- Otero	Slight----------	Slight----------	Severe: slope.	Slight.
48*: Otero----------	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Tassel----------	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Moderate: slope.
49---------- Paoli	Slight----------	Slight----------	Moderate: slope.	Slight.
50---------- Paoli	Slight----------	Slight----------	Severe: slope.	Slight.
51---------- Peetz	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight.
52*: Peetz----------	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight.
Altvan----------	Slight----------	Slight----------	Severe: slope.	Slight.
53*: Peetz----------	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.
Rock outcrop.				
54---------- Platner	Moderate: dusty.	Moderate: dusty.	Moderate: small stones, dusty.	Moderate: dusty.
55---------- Renohill	Slight----------	Slight----------	Moderate: slope, small stones, depth to rock.	Slight.
56---------- Renohill	Slight----------	Slight----------	Severe: slope.	Slight.
57*: Renohill----------	Slight----------	Slight----------	Severe: slope.	Slight.
Shingle----------	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, small stones, depth to rock.	Slight.

See footnote at end of table.

TABLE 3.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
58--- Rosebud	Slight	Slight	Moderate: slope, small stones, depth to rock.	Slight.
59--- Rosebud	Slight	Slight	Severe: slope.	Slight.
60--- Shingle	Severe: depth to rock.	Severe: depth to rock.	Severe: small stones, depth to rock.	Slight.
61--- Stoneham	Slight	Slight	Moderate: slope, small stones.	Slight.
62--- Stoneham	Slight	Slight	Severe: slope.	Slight.
63--- Tassel	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight.
64--- Terry	Slight	Slight	Moderate: small stones.	Slight.
65--- Terry	Slight	Slight	Severe: slope.	Slight.
66*:				
Thedalund---	Moderate: dusty.	Moderate: dusty.	Moderate: small stones.	Moderate: dusty.
Keota---	Moderate: dusty.	Moderate: dusty.	Moderate: dusty.	Severe: erodes easily.
67*:				
Thedalund---	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Moderate: dusty.
Keota---	Moderate: dusty.	Moderate: dusty.	Severe: slope.	Severe: erodes easily.
68--- Treon	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight.
69*:				
Treon---	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight.
Rock outcrop.				
70*:				
Ustic Torriorthents.				
Rock outcrop.				
71--- Vona	Slight	Slight	Slight	Slight.
72--- Vona	Slight	Slight	Severe: slope.	Slight.
73--- Vona	Slight	Slight	Slight	Slight.

See footnote at end of table.

TABLE 3.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
74---------- Vona	Slight----------	Slight----------	Severe: slope.	Slight.
75---------- Wages	Slight----------	Slight----------	Moderate: slope, small stones.	Slight.
76---------- Wages	Slight----------	Slight----------	Severe: slope.	Slight.
77---------- Weld	Moderate: dusty.	Moderate: dusty.	Moderate: slope, dusty.	Moderate: dusty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 4.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
1 Altvan	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.
2 Altvan	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.
3*: Argiustolls.					
Rock outcrop.					
4 Ascalon	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.
5 Ascalon	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.
6*: Ascalon	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.
Blakeland	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
7*: Ascalon	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: frost action.
Bushman	Slight	Slight	Slight	Slight	Slight.
Curabith	Severe: cutbanks cave.	Slight	Slight	Slight	Slight.
8*: Ascalon	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.
Bushman	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Curabith	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
9 Avar	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.
10*: Avar	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action.
Manzanola	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
11*: Badland					
12 Bankard	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.

See footnote at end of table.

TABLE 4.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
13---------- Blakeland	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight.
14---------- Blakeland	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
15---------- Bresser	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Moderate: frost action.
16---------- Bresser	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Moderate: frost action.
17---------- Bushman	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
18---------- Bushman	Slight----------	Slight----------	Slight----------	Moderate: slope.	Slight.
19*: Bushman----------	Slight----------	Slight----------	Slight----------	Moderate: slope.	Slight.
Curabith----------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Canyon----------	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock.
20---------- Cascajo	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
21---------- Cushman	Moderate: depth to rock.	Slight----------	Moderate: depth to rock.	Slight----------	Slight.
22---------- Cushman	Moderate: depth to rock.	Slight----------	Moderate: depth to rock.	Moderate: slope.	Slight.
23---------- Dacono	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight.
24---------- Eckley	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight.
25---------- Eckley	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Slight.
26*: Eckley----------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Dix----------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Blakeland---------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
27---------- Epping	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock.
28*: Haplaquolls.					
Fluvaquents.					
29---------- Haverson	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.

See footnote at end of table.

TABLE 4.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
30---- Keith	Slight----	Moderate: shrink-swell.	Slight----	Moderate: shrink-swell.	Severe: low strength.
31*:					
Kim----	Slight----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.
Mitchell----	Slight----	Slight----	Slight----	Slight----	Slight.
32*:					
Kim----	Slight----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell.
Mitchell----	Slight----	Slight----	Slight----	Moderate: slope.	Slight.
33*:					
Kim----	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: slope, shrink-swell.
Shingle----	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.
34---- Manter	Severe: cutbanks cave.	Slight----	Slight----	Slight----	Moderate: frost action.
35---- Manter	Severe: cutbanks cave.	Slight----	Slight----	Moderate: slope.	Moderate: frost action.
36---- Manzanola	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
37---- Midway	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock.	Severe: shrink-swell.	Severe: low strength, slope, shrink-swell.
38---- Nucla	Slight----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: frost action, shrink-swell.
39---- Nucla	Slight----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: frost action, shrink-swell.
40, 41---- Nunn	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.
42---- Olney	Severe: cutbanks cave.	Slight----	Slight----	Slight----	Slight.
43---- Olney	Severe: cutbanks cave.	Slight----	Slight----	Moderate: slope.	Slight.
44---- Olney	Severe: cutbanks cave.	Slight----	Slight----	Slight----	Slight.
45---- Olney	Severe: cutbanks cave.	Slight----	Slight----	Moderate: slope.	Slight.
46---- Otero	Slight----	Slight----	Slight----	Slight----	Slight.

See footnote at end of table.

TABLE 4.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
47---------- Otero	Slight----------	Slight----------	Slight----------	Moderate: slope.	Slight.
48*:					
Otero----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Tassel----------	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.
49---------- Paoli	Slight----------	Slight----------	Slight----------	Slight----------	Moderate: frost action.
50---------- Paoli	Slight----------	Slight----------	Slight----------	Moderate: slope.	Moderate: frost action.
51---------- Peetz	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
52*:					
Peetz----------	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Altvan----------	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Moderate: frost action.
53*:					
Peetz----------	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Rock outcrop.					
54---------- Platner	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
55---------- Renohill	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
56---------- Renohill	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
57*:					
Renohill----------	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Shingle----------	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Moderate: depth to rock, low strength.
58---------- Rosebud	Moderate: depth to rock.	Slight----------	Moderate: depth to rock.	Slight----------	Moderate: frost action.
59---------- Rosebud	Moderate: depth to rock.	Slight----------	Moderate: depth to rock.	Moderate: slope.	Moderate: frost action.
60---------- Shingle	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Moderate: depth to rock, low strength.
61---------- Stoneham	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.

See footnote at end of table.

TABLE 4.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
62---------- Stoneham	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell.
63---------- Tassel	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope.
64---------- Terry	Severe: cutbanks cave.	Slight----------	Moderate: depth to rock.	Slight----------	Slight.
65---------- Terry	Severe: cutbanks cave.	Slight----------	Moderate: depth to rock.	Moderate: slope.	Slight.
66*: Thedalund--------	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.
Keota----------	Moderate: depth to rock.	Slight----------	Moderate: depth to rock.	Slight----------	Moderate: low strength.
67*: Thedalund--------	Moderate: depth to rock.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Moderate: shrink-swell.
Keota----------	Moderate: depth to rock.	Slight----------	Moderate: depth to rock.	Moderate: slope.	Moderate: low strength.
68---------- Treon	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope, frost action.
69*: Treon----------	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope, frost action.
Rock outcrop.					
70*: Ustic Torriorthents.					
Rock outcrop.					
71---------- Vona	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight.
72---------- Vona	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Slight.
73---------- Vona	Severe: cutbanks cave.	Slight----------	Slight----------	Slight----------	Slight.
74---------- Vona	Severe: cutbanks cave.	Slight----------	Slight----------	Moderate: slope.	Slight.
75---------- Wages	Slight----------	Slight----------	Slight----------	Slight----------	Moderate: frost action.
76---------- Wages	Slight----------	Slight----------	Slight----------	Moderate: slope.	Moderate: frost action.

See footnote at end of table.

TABLE 4.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
77---------- Weld	Slight----------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, frost action, shrink-swell.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 5.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1 Altvan	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
2 Altvan	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
3*: Argiustolls.					
Rock outcrop.					
4 Ascalon	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
5 Ascalon	Moderate: percs slowly.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
6*: Ascalon	Moderate: percs slowly, slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: too sandy, slope.
Blakeland	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
7*: Ascalon	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
Bushman	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
Curabith	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones.
8*: Ascalon	Moderate: percs slowly, slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: too sandy, slope.
Bushman	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: slope.
Curabith	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: small stones.
9 Avar	Severe: percs slowly.	Severe: flooding.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
10*: Avar	Severe: percs slowly.	Severe: flooding.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
Manzanola	Severe: percs slowly.	Moderate: seepage.	Slight	Slight	Good.

See footnote at end of table.

TABLE 5.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
11*. Badland					
12---------- Bankard	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, too sandy.	Severe: flooding.	Poor: seepage, too sandy.
13---------- Blakeland	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
14---------- Blakeland	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
15, 16---------- Bresser	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: small stones.
17, 18---------- Bushman	Slight----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
19*: Bushman----------	Slight----------	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
Curabith----------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: small stones.
Canyon----------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, small stones.
20---------- Cascajo	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.	Moderate: slope.	Poor: seepage, too sandy, small stones.
21---------- Cushman	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
22---------- Cushman	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
23---------- Dacono	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
24---------- Eckley	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
25---------- Eckley	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
26*: Eckley----------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.

See footnote at end of table.

TABLE 5.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
26*:					
Dix	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Blakeland	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
27 Epping	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
28*:					
Haplaquolls.					
Fluvaquents.					
29 Haverson	Moderate: flooding, percs slowly.	Severe: flooding.	Severe: too sandy.	Moderate: flooding.	Poor: too sandy.
30 Keith	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
31*:					
Kim	Moderate: percs slowly.	Moderate: seepage, slope.	Slight	Slight	Fair: small stones.
Mitchell	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
32*:					
Kim	Moderate: percs slowly.	Severe: slope.	Slight	Slight	Fair: small stones.
Mitchell	Slight	Severe: slope.	Slight	Slight	Good.
33*:					
Kim	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: small stones, slope.
Shingle	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
34, 35 Manter	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: too sandy.
36 Manzanola	Severe: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
37 Midway	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack.
38 Nucla	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey, small stones.
39 Nucla	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey, small stones.

See footnote at end of table.

TABLE 5.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
40, 41---------- Nunn	Severe: percs slowly.	Moderate: slope.	Severe: seepage, too clayey.	Slight----------	Poor: too clayey, hard to pack.
42, 43, 44---------- Olney	Slight----------	Severe: seepage.	Moderate: too sandy.	Slight----------	Fair: too sandy.
45---------- Olney	Slight----------	Severe: seepage, slope.	Moderate: too sandy.	Slight----------	Fair: too sandy.
46, 47---------- Otero	Slight----------	Severe: seepage.	Slight----------	Slight----------	Fair: small stones.
48*: Otero----------	Severe: slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.	Poor: slope.
Tassel----------	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, slope.
49---------- Paoli	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
50---------- Paoli	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Good.
51---------- Peetz	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
52*: Peetz----------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
Altvan----------	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
53*: Peetz----------	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
Rock outcrop.					
54---------- Platner	Severe: percs slowly.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: small stones.
55---------- Renohill	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
56---------- Renohill	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
57*: Renohill----------	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.

See footnote at end of table.

TABLE 5.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
57*:					
Shingle	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
58---------- Rosebud	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
59---------- Rosebud	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
60---------- Shingle	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
61---------- Stoneham	Moderate: percs slowly.	Severe: seepage.	Slight----------	Slight----------	Good.
62---------- Stoneham	Moderate: percs slowly.	Severe: seepage, slope.	Slight----------	Slight----------	Good.
63---------- Tassel	Severe: depth to rock.	Severe: seepage, depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
64, 65---------- Terry	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
66*, 67*:					
Thedalund----------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
Keota----------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
68---------- Treon	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: area reclaim.
69*:					
Treon----------	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: area reclaim.
Rock outcrop.					
70*:					
Ustic Torriorthents.					
Rock outcrop.					
71, 72, 73, 74------ Vona	Severe: poor filter.	Severe: seepage.	Moderate: too sandy.	Slight----------	Fair: too sandy.
75---------- Wages	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Slight----------	Good.
76---------- Wages	Moderate: percs slowly.	Severe: seepage, slope.	Severe: seepage.	Slight----------	Good.
77---------- Weld	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight----------	Fair: too clayey.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1, 2 Altvan	Good	Probable	Improbable: too sandy.	Fair: small stones, area reclaim, thin layer.
3*: Argiustolls.				
Rock outcrop.				
4, 5 Ascalon	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
6*: Ascalon	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
Blakeland	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
7*: Ascalon	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Bushman	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Curabith	Good	Probable	Probable	Poor: small stones, area reclaim.
8*: Ascalon	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
Bushman	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
Curabith	Good	Probable	Probable	Poor: small stones, area reclaim.
9 Avar	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
10*: Avar	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Manzanola	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
11*. Badland				
12 Bankard	Good	Probable	Improbable: too sandy.	Poor: small stones, area reclaim.

See footnote at end of table.

TABLE 6.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
13, 14---------- Blakeland	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
15, 16---------- Bresser	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
17, 18---------- Bushman	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
19*: Bushman----------	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Curabith----------	Good----------	Probable----------	Probable----------	Poor: small stones, area reclaim.
Canyon----------	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
20---------- Cascajo	Good----------	Probable----------	Probable----------	Poor: small stones, area reclaim.
21, 22---------- Cushman	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.
23---------- Dacono	Good----------	Probable----------	Probable----------	Poor: small stones, area reclaim.
24, 25---------- Eckley	Good----------	Probable----------	Probable----------	Poor: small stones, area reclaim.
26*: Eckley----------	Good----------	Probable----------	Probable----------	Poor: small stones, area reclaim.
Dix----------	Good----------	Probable----------	Probable----------	Poor: area reclaim, small stones.
Blakeland----------	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
27---------- Epping	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
28*: Haplaquolls. Fluvaquents.				
29---------- Haverson	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
30---------- Keith	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
31*, 32*: Kim----------	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.

See footnote at end of table.

TABLE 6.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
31*, 32*: Mitchell	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
33*: Kim	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Shingle	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
34, 35 Manter	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
36 Manzanola	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
37 Midway	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
38, 39 Nucla	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
40, 41 Nunn	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
42, 43 Olney	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.
44, 45 Olney	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
46, 47 Otero	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
48*: Otero	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Tassel	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, slope.
49, 50 Paoli	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
51 Peetz	Good	Probable	Probable	Poor: small stones, area reclaim.
52*: Peetz	Good	Probable	Probable	Poor: small stones, area reclaim.
Altvan	Good	Probable	Improbable: too sandy.	Fair: small stones, area reclaim, thin layer.

See footnote at end of table.

TABLE 6.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
53*:				
Peetz	Fair: slope.	Probable	Probable	Poor: small stones, area reclaim, slope.
Rock outcrop.				
54 Platner	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
55, 56 Renohill	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
57*:				
Renohill	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
Shingle	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
58, 59 Rosebud	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.
60 Shingle	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
61, 62 Stoneham	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
63 Tassel	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
64, 65 Terry	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
66*, 67*:				
Thedalund	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Keota	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, thin layer.
68 Treon	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
69*:				
Treon	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
Rock outcrop.				
70*:				
Ustic Torriorthents.				
Rock outcrop.				
71, 72 Vona	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.

See footnote at end of table.

TABLE 6.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
73, 74---------- Vona	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
75, 76---------- Wages	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.
77---------- Weld	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
1, 2---------- Altvan	Severe: seepage.	Severe: seepage.	Deep to water	Soil blowing, slope.	Too sandy, soil blowing.	Favorable.
3*: Argiustolls.						
Rock outcrop.						
4, 5---------- Ascalon	Severe: seepage.	Severe: piping.	Deep to water	Droughty, soil blowing, slope.	Soil blowing---	Droughty.
6*: Ascalon----------	Severe: seepage, slope.	Severe: piping.	Deep to water	Droughty, soil blowing, slope.	Slope, soil blowing.	Slope, droughty.
Blakeland--------	Severe: seepage, slope.	Slight---------	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
7*: Ascalon----------	Severe: seepage.	Severe: piping.	Deep to water	Droughty, soil blowing.	Soil blowing---	Droughty.
Bushman----------	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing---	Soil blowing---	Favorable.
Curabith----------	Severe: seepage.	Severe: seepage.	Deep to water	Droughty-------	Large stones---	Droughty.
8*: Ascalon----------	Severe: seepage, slope.	Severe: piping.	Deep to water	Droughty, soil blowing, slope.	Slope, soil blowing.	Slope, droughty.
Bushman----------	Severe: seepage, slope.	Severe: piping.	Deep to water	Soil blowing, slope.	Slope, soil blowing.	Slope.
Curabith----------	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope, large stones.	Slope, droughty.
9---------- Avar	Moderate: seepage.	Severe: piping.	Deep to water	Excess sodium, excess salt.	Soil blowing---	Excess sodium, excess salt.
10*: Avar----------	Moderate: seepage.	Severe: piping.	Deep to water	Excess sodium, excess salt.	Soil blowing---	Excess sodium, excess salt.
Manzanola--------	Moderate: seepage.	Moderate: thin layer.	Deep to water	Percs slowly---	Percs slowly---	Percs slowly.
11*. Badland						
12---------- Bankard	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
13---------- Blakeland	Severe: seepage.	Slight---------	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.

See footnote at end of table.

TABLE 7.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
14---- Blakeland	Severe: seepage, slope.	Slight----	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
15, 16---- Bresser	Severe: seepage.	Slight----	Deep to water	Droughty, soil blowing.	Too sandy, soil blowing.	Droughty.
17---- Bushman	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing---	Soil blowing---	Favorable.
18---- Bushman	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, slope.	Soil blowing---	Favorable.
19*:						
Bushman----	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, slope.	Soil blowing---	Favorable.
Curabith----	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope, large stones.	Slope, droughty.
Canyon----	Severe: depth to rock.	Severe: piping.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
20---- Cascajo	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope, too sandy.	Slope, droughty.
21, 22---- Cushman	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Depth to rock, slope, erodes easily.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
23---- Dacono	Severe: seepage.	Severe: seepage.	Deep to water	Slope----	Too sandy----	Favorable.
24, 25---- Eckley	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Too sandy, soil blowing.	Droughty.
26*:						
Eckley----	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, soil blowing, slope.	Slope, too sandy, soil blowing.	Slope, droughty.
Dix----	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.
Blakeland----	Severe: seepage, slope.	Slight----	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty.
27---- Epping	Severe: depth to rock.	Severe: piping.	Deep to water	Depth to rock, slope, erodes easily.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
28*: Haplaquolls. Fluvaquents.						
29---- Haverson	Moderate: seepage.	Severe: piping.	Deep to water	Excess salt----	Too sandy----	Excess salt.
30---- Keith	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope----	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 7.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
31*, 32*:						
Kim	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, excess salt.	Favorable	Favorable.
Mitchell	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
33*:						
Kim	Severe: slope.	Severe: piping.	Deep to water	Slope, excess salt.	Slope	Slope.
Shingle	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
34, 35--- Manter	Severe: seepage.	Severe: seepage, piping.	Deep to water	Soil blowing	Too sandy, soil blowing.	Favorable.
36--- Manzanola	Moderate: seepage.	Moderate: thin layer.	Deep to water	Percs slowly	Percs slowly	Percs slowly.
37--- Midway	Severe: depth to rock.	Moderate: hard to pack.	Deep to water	Percs slowly, depth to rock.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
38--- Nucla	Moderate: seepage.	Severe: piping.	Deep to water	Favorable	Favorable	Favorable.
39--- Nucla	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope	Favorable	Favorable.
40, 41--- Nunn	Moderate: slope.	Moderate: thin layer, hard to pack.	Deep to water	Percs slowly, slope.	Percs slowly	Percs slowly.
42, 43--- Olney	Severe: seepage.	Severe: piping.	Deep to water	Droughty, fast intake, soil blowing.	Soil blowing	Droughty.
44, 45--- Olney	Severe: seepage.	Severe: piping.	Deep to water	Droughty, soil blowing, slope.	Soil blowing	Droughty.
46, 47--- Otero	Severe: seepage.	Severe: piping.	Deep to water	Droughty, soil blowing.	Soil blowing	Droughty.
48*:						
Otero	Severe: seepage, slope.	Severe: piping.	Deep to water	Droughty, soil blowing.	Slope, soil blowing.	Slope, droughty.
Tassel	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Fast intake, soil blowing.	Slope, depth to rock, soil blowing.	Slope, depth to rock.
49, 50--- Paoli	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, slope.	Soil blowing	Favorable.
51--- Peetz	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope, too sandy.	Slope, droughty.
52*:						
Peetz	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope, too sandy.	Slope, droughty.

See footnote at end of table.

TABLE 7.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
52*:						
Altvan	Severe: seepage.	Severe: seepage.	Deep to water	Soil blowing, slope.	Too sandy, soil blowing.	Favorable.
53*:						
Peetz	Severe: seepage, slope.	Severe: seepage.	Deep to water	Droughty, slope.	Slope, too sandy.	Slope, droughty.
Rock outcrop.						
54 Platner	Severe: seepage.	Severe: piping.	Deep to water	Percs slowly	Favorable	Percs slowly.
55, 56 Renohill	Moderate: depth to rock, slope.	Severe: thin layer.	Deep to water	Percs slowly, depth to rock, slope.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
57*:						
Renohill	Moderate: depth to rock, slope.	Severe: thin layer.	Deep to water	Percs slowly, depth to rock, slope.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
Shingle	Severe: depth to rock.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
58, 59 Rosebud	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Soil blowing, depth to rock, slope.	Depth to rock, soil blowing.	Depth to rock.
60 Shingle	Severe: depth to rock.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
61, 62 Stoneham	Moderate: seepage, slope.	Severe: piping.	Deep to water	Soil blowing, slope.	Soil blowing	Favorable.
63 Tassel	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Fast intake, soil blowing.	Slope, depth to rock, soil blowing.	Slope, depth to rock.
64, 65 Terry	Severe: seepage.	Severe: piping.	Deep to water	Soil blowing, depth to rock.	Depth to rock, soil blowing.	Depth to rock.
66*:						
Thedalund	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water	Depth to rock, excess salt.	Depth to rock	Depth to rock.
Keota	Moderate: seepage, depth to rock.	Severe: piping.	Deep to water	Depth to rock, erodes easily.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
67*:						
Thedalund	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Depth to rock, slope, excess salt.	Depth to rock	Depth to rock.
Keota	Moderate: seepage, depth to rock, slope.	Severe: piping.	Deep to water	Depth to rock, slope, erodes easily.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
68 Treon	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Soil blowing, depth to rock, slope.	Slope, depth to rock, soil blowing.	Slope, depth to rock.

See footnote at end of table.

TABLE 7.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
69*:						
Treon	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Soil blowing, depth to rock, slope.	Slope, depth to rock, soil blowing.	Slope, depth to rock.
Rock outcrop.						
70*:						
Ustic Torriorthents.						
Rock outcrop.						
71---------- Vona	Severe: seepage.	Severe: seepage, piping.	Deep to water	Fast intake, soil blowing.	Too sandy, soil blowing.	Favorable.
72---------- Vona	Severe: seepage.	Severe: seepage, piping.	Deep to water	Fast intake, soil blowing, slope.	Too sandy, soil blowing.	Favorable.
73---------- Vona	Severe: seepage.	Severe: seepage, piping.	Deep to water	Soil blowing---	Too sandy, soil blowing.	Favorable.
74---------- Vona	Severe: seepage.	Severe: seepage, piping.	Deep to water	Soil blowing, slope.	Too sandy, soil blowing.	Favorable.
75, 76---------- Wages	Moderate: seepage, slope.	Severe: piping.	Deep to water	Soil blowing, slope.	Soil blowing---	Favorable.
77---------- Weld	Moderate: seepage, slope.	Severe: piping.	Deep to water	Percs slowly, slope.	Favorable------	Percs slowly.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
1----------	0-6	Fine sandy loam	ML, SM	A-4	0	100	100	70-85	40-55	25-35	NP-10
Altvan	6-27	Clay loam, loam, sandy clay loam.	CL	A-6, A-7	0	95-100	95-100	85-100	70-80	35-50	15-25
	27-60	Gravelly sand, gravelly coarse sand, coarse sand.	SP, SP-SM	A-1	0	75-95	70-90	25-35	0-10	---	NP
2----------	0-3	Fine sandy loam	ML, SM	A-4	0	100	100	70-85	40-55	25-35	NP-10
Altvan	3-23	Clay loam, loam, sandy clay loam.	CL	A-6, A-7	0	95-100	95-100	85-100	70-80	35-50	15-25
	23-60	Gravelly sand, gravelly coarse sand, coarse sand.	SP, SP-SM	A-1	0	75-95	70-90	25-35	0-10	---	NP
3*:											
Argiustolls.											
Rock outcrop.											
4----------	0-8	Fine sandy loam	SM	A-2, A-4	0	95-100	90-100	70-95	25-50	15-25	NP-5
Ascalon	8-22	Sandy clay loam, clay loam, loam.	SC, CL	A-6	0	95-100	90-100	80-100	40-55	20-40	10-20
	22-60	Fine sandy loam, loamy fine sand, sandy loam.	SM	A-2	0	95-100	95-100	70-95	20-35	---	NP
5----------	0-6	Fine sandy loam	SM	A-2, A-4	0	95-100	90-100	70-95	25-50	15-25	NP-5
Ascalon	6-21	Sandy clay loam, clay loam, loam.	SC, CL	A-6	0	95-100	90-100	80-100	40-55	20-40	10-20
	21-60	Fine sandy loam, loamy fine sand, sandy loam.	SM	A-2	0	95-100	95-100	70-95	20-35	---	NP
6*:											
Ascalon----------	0-8	Fine sandy loam	SM	A-2, A-4	0	95-100	90-100	70-95	25-50	15-25	NP-5
	8-26	Sandy clay loam, clay loam, loam.	SC, CL	A-6	0	95-100	90-100	80-100	40-55	20-40	10-20
	26-60	Fine sandy loam, loamy fine sand, sandy loam.	SM	A-2	0	95-100	95-100	70-95	20-35	---	NP
Blakeland--------	0-15	Loamy sand--------	SM-SC	A-2	0	95-100	90-100	40-60	15-30	10-30	5-10
	15-60	Loamy sand, loamy coarse sand, sand.	SP-SC, SM-SC	A-2	0	95-100	80-100	35-60	5-25	20-25	5-10
7*, 8*:											
Ascalon----------	0-8	Fine sandy loam	SM	A-2, A-4	0	95-100	90-100	70-95	25-50	15-25	NP-5
	8-26	Sandy clay loam, clay loam, loam.	SC, CL	A-6	0	95-100	90-100	80-100	40-55	20-40	10-20
	26-60	Fine sandy loam, loamy fine sand, sandy loam.	SM	A-2	0	95-100	95-100	70-95	20-35	---	NP
Bushman----------	0-10	Fine sandy loam	SM, ML	A-4	0	80-100	75-100	65-85	35-55	20-25	NP-5
	10-60	Very fine sandy loam, loam, sandy loam.	ML, SM	A-4	0	80-100	75-100	70-85	40-55	20-25	NP-5

See footnote at end of table.

TABLE 8.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
7*, 8*:											
Curabith	0-10	Loam	SM, SM-SC, ML, CL-ML	A-4	0	95-100	90-100	65-85	35-55	25-35	5-10
	10-25	Very channery sandy loam.	GM, GM-GC, SM, SM-SC	A-1, A-2	10-20	40-60	35-55	25-35	10-20	20-30	NP-10
	25-42	Channery sandy loam.	SM	A-1, A-2	5-10	60-80	55-75	35-65	15-35	20-30	NP-10
	42-60	Very channery loamy sand.	GP-GM	A-1	45-55	30-50	25-45	15-25	5-10	---	NP
9	0-3	Fine sandy loam	SM	A-2, A-4	0	90-100	85-100	55-95	30-50	20-30	NP-5
Avar	3-8	Clay loam, clay	CL, CH	A-6, A-7	0	100	95-100	85-100	65-90	35-50	20-35
	8-60	Sandy clay loam, clay loam, sandy loam.	SC, SM-SC, CL, CL-ML	A-6, A-4, A-2	0	100	95-100	55-95	30-65	20-35	5-15
10*:											
Avar	0-3	Fine sandy loam	SM	A-2, A-4	0	90-100	85-100	55-95	30-50	20-30	NP-5
	3-8	Clay loam, clay	CL, CH	A-6, A-7	0	100	95-100	85-100	65-90	35-50	20-35
	8-60	Sandy clay loam, clay loam, sandy loam.	SC, SM-SC, CL, CL-ML	A-6, A-4, A-2	0	100	95-100	55-95	30-65	20-35	5-15
Manzanola	0-3	Clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	80-95	70-95	50-75	25-40	5-20
	3-60	Clay loam, clay, silty clay.	CL	A-6, A-7	0-5	95-100	90-100	85-95	65-90	35-50	20-30
11*. Badland											
12	0-6	Loamy fine sand	SP-SM, SM	A-2, A-3	0	95-100	80-100	50-75	5-25	---	NP
Bankard	6-34	Fine sand, sand, loamy sand.	SP-SM, SM	A-2, A-3, A-1	0-5	80-100	75-100	40-70	5-35	---	NP
	34-60	Gravelly sand, very gravelly loamy sand, very gravelly sand.	GP, SP, GP-GM, SP-SM	A-1, A-2, A-3	0-5	35-75	35-75	20-60	0-15	---	NP
13	0-15	Loamy sand	SM-SC	A-2	0	95-100	90-100	40-60	15-30	10-30	5-10
Blakeland	15-60	Loamy sand, loamy coarse sand, sand.	SP-SC, SM-SC	A-2	0	95-100	80-100	35-60	5-25	20-25	5-10
14	0-12	Loamy sand	SM-SC	A-2	0	95-100	90-100	40-60	15-30	10-30	5-10
Blakeland	12-60	Loamy sand, loamy coarse sand, sand.	SP-SC, SM-SC	A-2	0	95-100	80-100	35-60	5-25	20-25	5-10
15	0-15	Sandy loam	SM	A-1, A-2	0	95-100	75-100	35-50	20-35	15-25	NP-5
Bresser	15-37	Sandy clay loam, clay loam.	SC	A-2, A-6, A-7	0	95-100	75-100	50-70	30-50	30-55	15-30
	37-60	Loamy coarse sand, gravelly loamy sand, very gravelly loamy sand.	SP-SC	A-2	0-5	80-100	35-85	20-50	5-10	20-30	5-10
16	0-15	Sandy loam	SM	A-1, A-2	0	95-100	75-100	35-50	20-35	15-25	NP-5
Bresser	15-34	Sandy clay loam, clay loam.	SC	A-2, A-6, A-7	0	95-100	75-100	50-70	30-50	30-55	15-30
	34-60	Loamy coarse sand, gravelly loamy sand, very gravelly loamy sand.	SP-SC	A-2	0-5	80-100	35-85	20-50	5-10	20-30	5-10

See footnote at end of table.

TABLE 8.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
17---------- Bushman	0-10	Fine sandy loam	SM, ML	A-4	0	80-100	75-100	65-85	35-55	20-25	NP-5
	10-60	Very fine sandy loam, loam, sandy loam.	ML, SM	A-4	0	80-100	75-100	70-85	40-55	20-25	NP-5
18---------- Bushman	0-6	Fine sandy loam	SM, ML	A-4	0	80-100	75-100	65-85	35-55	20-25	NP-5
	6-60	Very fine sandy loam, loam, sandy loam.	ML, SM	A-4	0	80-100	75-100	70-85	40-55	20-25	NP-5
19*:											
Bushman----------	0-6	Fine sandy loam	SM, ML	A-4	0	80-100	75-100	65-85	35-55	20-25	NP-5
	6-60	Very fine sandy loam, loam, sandy loam.	ML, SM	A-4	0	80-100	75-100	70-85	40-55	20-25	NP-5
Curabith--------	0-10	Loam----------	SM, SM-SC, ML, CL-ML	A-4	0	95-100	90-100	65-85	35-55	25-35	5-10
	10-25	Very channery sandy loam.	GM, GM-GC, SM, SM-SC	A-1, A-2	10-20	40-60	35-55	25-35	10-20	20-30	NP-10
	25-42	Channery sandy loam.	SM	A-1, A-2	5-10	60-80	55-75	35-65	15-35	20-30	NP-10
	42-60	Very channery loamy sand.	GP-GM	A-1	45-55	30-50	25-45	15-25	5-10	---	NP
Canyon----------	0-3	Gravelly loam----	GM, SM	A-4	0-5	60-80	50-75	45-60	35-50	---	NP
	3-14	Very fine sandy loam, loam, gravelly loam.	ML, SM, SC, GM	A-4	0-5	60-95	50-95	45-95	35-75	15-20	NP-10
	14	Weathered bedrock	---	---	---	---	---	---	---	---	---
20---------- Cascajo	0-3	Gravelly sandy loam.	GM, SM	A-1, A-2, A-4	0-10	50-75	50-75	30-50	10-40	---	NP
	3-24	Very gravelly sandy loam, very gravelly loamy sand, very gravelly sand.	GP-GM, GP, GM	A-1	0-15	15-50	15-50	5-30	0-20	---	NP
	24-60	Very gravelly loamy sand, very gravelly sand, gravelly sand.	GP, SP, GP-GM, SP-SM	A-1	0-15	10-60	10-60	5-30	0-10	---	NP
21, 22---------- Cushman	0-10	Fine sandy loam	SM-SC	A-2, A-4	0	100	75-100	70-90	25-50	20-25	5-10
	10-29	Clay loam, sandy clay loam, loam.	CL	A-6	0	100	90-100	85-95	70-85	25-35	10-15
	29	Weathered bedrock	---	---	---	---	---	---	---	---	---
23---------- Dacono	0-4	Clay loam--------	CL	A-6	0	85-100	75-100	75-95	70-80	30-40	10-20
	4-21	Clay loam, clay, gravelly clay loam.	CL	A-6, A-7	0	75-100	60-100	55-95	50-85	35-45	15-25
	21-26	Sandy clay loam, loam, silt loam.	CL, SC	A-6	0	75-100	75-100	50-95	40-85	25-40	10-20
	26-60	Sand, gravelly sand.	SP	A-1	0	50-90	50-90	20-45	0-5	---	NP
24---------- Eckley	0-9	Sandy clay loam	SC, CL, CL-ML, SM-SC	A-6, A-4	0	95-100	95-100	75-90	35-55	25-35	5-15
	9-15	Gravelly sandy clay loam, sandy clay loam, clay loam.	SC, GC, CL	A-2, A-6	0	55-85	50-85	30-65	20-55	25-40	10-20
	15-60	Gravelly sand, gravelly loamy sand, very gravelly sand.	SM, SP-SM, GP-GM, GM	A-1	0	50-85	30-75	15-45	5-15	---	NP

See footnote at end of table.

TABLE 8.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
25---------- Eckley	0-8	Sandy clay loam	SC, CL, CL-ML, SM-SC	A-6, A-4	0	95-100	95-100	75-90	35-55	25-35	5-15
	8-14	Gravelly sandy clay loam, sandy clay loam, clay loam.	SC, GC, CL	A-2, A-6	0	55-85	50-85	30-65	20-55	25-40	10-20
	14-60	Gravelly sand, gravelly loamy sand, very gravelly sand.	SM, SP-SM, GP-GM, GM	A-1	0	50-85	30-75	15-45	5-15	---	NP
26*:											
Eckley----------	0-8	Sandy clay loam	SC, CL, CL-ML, SM-SC	A-6, A-4	0	95-100	95-100	75-90	35-55	25-35	5-15
	8-14	Gravelly sandy clay loam, sandy clay loam, clay loam.	SC, GC, CL	A-2, A-6	0	55-85	50-85	30-65	20-55	25-40	10-20
	14-60	Gravelly sand, gravelly loamy sand, very gravelly sand.	SM, SP-SM, GP-GM, GM	A-1	0	50-85	30-75	15-45	5-15	---	NP
Dix----------	0-12	Gravelly loamy sand.	SM, SP-SM	A-1, A-2	0	50-80	50-75	30-60	5-25	---	NP
	12-37	Gravelly loamy coarse sand, very gravelly sand.	SP, SP-SM, SM, GP	A-1, A-2, A-3	0	40-90	35-75	15-60	4-25	---	NP
	37-60	Very gravelly coarse sand, very gravelly sand, gravelly coarse sand.	SP, GP, SP-SM, GP-GM	A-1	0-5	30-60	25-60	10-35	0-10	---	NP
Blakeland-------	0-12	Loamy sand-------	SM-SC	A-2	0	95-100	90-100	40-60	15-30	10-30	5-10
	12-60	Loamy sand, loamy coarse sand, sand.	SP-SC, SM-SC	A-2	0	95-100	80-100	35-60	5-25	20-25	5-10
27---------- Epping	0-3	Silt loam--------	ML, CL, CL-ML	A-4	0	100	95-100	90-100	70-85	15-30	NP-10
	3-17	Loam, silt loam, very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	85-95	60-75	15-35	NP-15
	17	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
28*:											
Haplaquolls.											
Fluvaquents.											
29---------- Haverson	0-12	Loam----------	ML	A-4	0	95-100	80-100	75-90	50-75	20-35	NP-10
	12-60	Stratified clay loam to sand.	ML	A-4	0	95-100	75-100	75-90	50-60	20-35	NP-10
30---------- Keith	0-4	Loam----------	ML, CL-ML	A-4	0	100	100	85-100	85-100	20-35	NP-10
	4-20	Silt loam, silty clay loam, loam.	CL	A-6, A-7	0	100	100	95-100	85-100	30-45	10-25
	20-60	Silt loam, loam, very fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	90-100	85-100	20-35	NP-15

See footnote at end of table.

TABLE 8.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
31*, 32*:											
Kim	0-3	Loam	ML	A-4	0-5	80-100	75-100	60-90	55-75	20-35	NP-5
	3-60	Loam, clay loam, very fine sandy loam.	CL, CL-ML, SC, SM-SC	A-4, A-6	0-5	80-100	75-100	70-95	35-85	25-40	5-15
Mitchell	0-7	Silt loam	ML, CL-ML	A-4	0	100	100	90-100	80-100	20-35	NP-10
	7-60	Loam, very fine sandy loam, silt loam.	ML, CL-ML	A-4	0	100	100	85-100	65-100	20-35	NP-10
33*:											
Kim	0-3	Loam	ML	A-4	0-5	80-100	75-100	60-90	55-75	20-35	NP-5
	3-60	Loam, clay loam, very fine sandy loam.	CL, CL-ML, SC, SM-SC	A-4, A-6	0-5	80-100	75-100	70-95	35-85	25-40	5-15
Shingle	0-4	Clay loam	CL	A-6	0-5	75-100	75-100	65-100	50-80	35-40	15-20
	4-11	Clay loam, loam	CL	A-6	0	75-100	75-100	65-100	50-80	30-40	10-20
	11	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
34, 35	0-3	Sandy loam	SM, ML	A-2, A-4	0	95-100	75-100	45-85	25-55	---	NP
Manter	3-28	Fine sandy loam, sandy loam.	SM, ML, CL-ML, SM-SC	A-2, A-4	0	95-100	75-100	50-85	30-55	15-25	NP-5
	28-60	Sandy loam, loamy sand, loamy fine sand.	SM	A-2, A-4, A-1	0	95-100	75-100	40-85	15-50	---	NP
36	0-3	Clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	80-95	70-95	50-75	25-40	5-20
Manzanola	3-48	Clay loam, clay, silty clay.	CL	A-6, A-7	0-5	95-100	90-100	85-95	65-90	35-50	20-30
	48-60	Clay loam, silty clay loam.	CL	A-6	0-5	95-100	90-100	80-95	60-90	30-40	10-20
37	0-3	Clay loam	CL	A-6	0	75-100	75-100	70-100	70-95	30-40	10-20
Midway	3-11	Clay, clay loam, silty clay loam.	CL, CH	A-6, A-7	0	95-100	95-100	90-100	70-95	35-60	20-35
	11	Weathered bedrock	---	---	---	---	---	---	---	---	---
38, 39	0-4	Loam	ML, SM	A-4	0-5	80-100	75-100	60-90	45-70	20-30	NP-5
Nucla	4-60	Loam, clay loam	CL-ML, CL	A-4, A-6	0-5	80-100	75-100	65-95	50-75	20-35	5-15
40	0-7	Loam	CL, SC, SM-SC, CL-ML	A-6, A-4	0-5	95-100	80-95	70-95	45-75	20-40	5-20
Nunn	7-23	Clay loam, clay	CL, CH	A-6, A-7	0-5	95-100	90-100	85-95	65-75	35-60	20-35
	23-60	Clay loam, loam, gravelly sandy clay loam.	CL, CL-ML, SM-SC, SC	A-4, A-6	0-5	80-100	60-100	60-90	35-75	15-40	5-20
41	0-8	Clay loam	CL, SC, SM-SC, CL-ML	A-6, A-4	0-5	95-100	80-95	70-95	45-75	20-40	5-20
Nunn	8-22	Clay loam, clay	CL, CH	A-6, A-7	0-5	95-100	90-100	85-95	65-75	35-60	20-35
	22-60	Clay loam, loam, gravelly sandy clay loam.	CL, CL-ML, SM-SC, SC	A-4, A-6	0-5	80-100	60-100	60-90	35-75	15-40	5-20
42	0-5	Loamy sand	SM	A-2	0	95-100	90-100	60-90	10-20	---	NP
Olney	5-34	Sandy clay loam, sandy loam.	SC, CL	A-6	0	95-100	90-100	80-100	40-55	25-35	10-20
	34-60	Sandy loam, sandy clay loam, fine sandy loam.	SC, SM-SC, CL, CL-ML	A-4, A-6	0	95-100	95-100	75-95	35-55	20-35	5-15

See footnote at end of table.

TABLE 8.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
43----------	0-4	Loamy sand-------	SM	A-2	0	95-100	90-100	60-90	10-20	---	NP
Olney	4-31	Sandy clay loam, sandy loam.	SC, CL	A-6	0	95-100	90-100	80-100	40-55	25-35	10-20
	31-60	Sandy loam, sandy clay loam, fine sandy loam.	SC, SM-SC, CL, CL-ML	A-4, A-6	0	95-100	95-100	75-95	35-55	20-35	5-15
44, 45----------	0-6	Fine sandy loam	SM	A-2	0	95-100	90-100	70-95	20-35	15-25	NP-5
Olney	6-18	Sandy clay loam, sandy loam.	SC, CL	A-6	0	95-100	90-100	80-100	40-55	20-40	10-20
	18-60	Sandy loam, sandy clay loam, fine sandy loam.	SC, SM-SC, CL, CL-ML	A-4, A-6	0	95-100	95-100	75-95	35-55	20-35	5-15
46, 47----------	0-5	Sandy loam-------	SM	A-2	0	95-100	75-100	50-80	10-35	20-25	NP-5
Otero	5-60	Sandy loam, fine sandy loam.	SM	A-2, A-1	0	90-100	75-100	40-80	20-35	15-25	NP-5
48*:											
Otero----------	0-5	Sandy loam-------	SM	A-2	0	95-100	75-100	50-80	10-35	20-25	NP-5
	5-60	Sandy loam, fine sandy loam.	SM	A-2, A-1	0	90-100	75-100	40-80	20-35	15-25	NP-5
Tassel----------	0-7	Loamy fine sand	SM	A-2	0	95-100	90-100	65-95	15-30	---	NP
	7-19	Fine sandy loam, loamy very fine sand.	ML, SM	A-4	0	95-100	90-100	75-95	40-65	30-35	NP-5
	19	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
49----------	0-15	Fine sandy loam	SM, ML	A-4	0	95-100	95-100	70-85	40-60	---	NP
Paoli	15-45	Fine sandy loam, sandy loam.	SM	A-4	0	80-100	80-100	60-85	35-50	---	NP
	45-60	Fine sandy loam, sandy loam.	SM	A-2, A-4	0	75-100	75-100	55-85	30-50	---	NP
50----------	0-13	Fine sandy loam	SM, ML	A-4	0	95-100	95-100	70-85	40-60	---	NP
Paoli	13-45	Fine sandy loam, sandy loam.	SM	A-4	0	80-100	80-100	60-85	35-50	---	NP
	45-60	Fine sandy loam, sandy loam.	SM	A-2, A-4	0	75-100	75-100	55-85	30-50	---	NP
51----------	0-4	Gravelly sandy loam.	SM	A-1, A-2	0-5	75-95	50-75	25-45	15-30	---	NP
Peetz	4-60	Very gravelly sand, very gravelly loamy sand.	GP, GP-GM	A-1	0-10	35-45	30-40	15-20	0-10	---	NP
52*:											
Peetz----------	0-4	Gravelly sandy loam.	SM	A-1, A-2	0-5	75-95	50-75	25-45	15-30	---	NP
	4-60	Very gravelly sand, very gravelly loamy sand.	GP, GP-GM	A-1	0-10	35-45	30-40	15-20	0-10	---	NP
Altvan----------	0-3	Fine sandy loam	ML, SM	A-4	0	100	100	70-85	40-55	25-35	NP-10
	3-23	Clay loam, loam, sandy clay loam.	CL	A-6, A-7	0	95-100	95-100	85-100	70-80	35-50	15-25
	23-60	Gravelly sand, gravelly coarse sand, coarse sand.	SP, SP-SM	A-1	0	75-95	70-90	25-35	0-10	---	NP

See footnote at end of table.

TABLE 8.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
53*:											
Peetz	0-4	Gravelly sandy loam.	SM	A-1, A-2	0-5	75-95	50-75	25-45	15-30	---	NP
	4-60	Very gravelly sand, very gravelly loamy sand.	GP, GP-GM	A-1	0-10	35-45	30-40	15-20	0-10	---	NP
Rock outcrop.											
54	0-4	Loam	CL-ML, CL	A-4, A-6	0	90-100	75-100	70-95	50-70	25-35	5-15
Platner	4-24	Clay, clay loam, silty clay loam.	CL, CH	A-7, A-6	0	90-100	85-100	80-100	60-95	35-60	15-30
	24-60	Gravelly sandy loam, sandy loam, fine sandy loam.	SM-SC, SC, CL-ML, CL	A-2, A-4, A-6	0	75-100	60-95	55-70	30-60	20-30	5-15
55	0-5	Fine sandy loam	SM, ML	A-4	0	85-100	80-100	70-80	45-55	---	NP
Renohill	5-18	Clay, clay loam	CL, CH	A-7, A-6	0	95-100	90-100	90-100	75-95	35-65	20-35
	18-32	Clay loam	CL	A-6	0	85-100	80-100	80-95	70-80	30-40	15-25
	32	Weathered bedrock	---	---	---	---	---	---	---	---	---
56	0-4	Fine sandy loam	SM, ML	A-4	0	85-100	80-100	70-80	45-55	---	NP
Renohill	4-17	Clay, clay loam	CL, CH	A-7, A-6	0	95-100	90-100	90-100	75-95	35-65	20-35
	17-29	Clay loam	CL	A-6	0	85-100	80-100	80-95	70-80	30-40	15-25
	29	Weathered bedrock	---	---	---	---	---	---	---	---	---
57*:											
Renohill	0-4	Fine sandy loam	SM, ML	A-4	0	85-100	80-100	70-80	45-55	---	NP
	4-13	Clay, clay loam	CL, CH	A-7, A-6	0	95-100	90-100	90-100	75-95	35-65	20-35
	13-29	Clay loam	CL	A-6	0	85-100	80-100	80-95	70-80	30-40	15-25
	29	Weathered bedrock	---	---	---	---	---	---	---	---	---
Shingle	0-4	Clay loam	CL	A-6	0-5	75-100	70-100	65-100	50-80	35-40	15-20
	4-11	Clay loam, loam	CL	A-6	0	75-100	75-100	65-100	50-80	30-40	10-20
	11	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
58	0-5	Fine sandy loam	CL, SC	A-4, A-6	0	95-100	80-100	70-85	40-55	25-40	10-20
Rosebud	5-19	Clay loam, loam	CL	A-6, A-7	0	95-100	80-100	80-100	60-85	30-50	10-25
	19-38	Sandy loam, sandy clay loam, very fine sandy loam.	SM, ML, SM-SC, CL-ML	A-4, A-6, A-2	0	95-100	80-100	60-85	30-60	20-40	NP-10
	38	Weathered bedrock	---	---	---	---	---	---	---	---	---
59	0-4	Fine sandy loam	CL, SC	A-4, A-6	0	95-100	80-100	70-85	40-55	25-40	10-20
Rosebud	4-16	Clay loam, loam	CL	A-6, A-7	0	95-100	80-100	80-100	60-85	30-50	10-25
	16-28	Sandy loam, sandy clay loam, very fine sandy loam.	SM, ML, SM-SC, CL-ML	A-4, A-6, A-2	0	95-100	80-100	60-85	30-60	20-40	NP-10
	28	Weathered bedrock	---	---	---	---	---	---	---	---	---
60	0-4	Clay loam	CL	A-6	0-5	75-100	70-100	65-100	50-80	35-40	15-20
Shingle	4-11	Clay loam, loam, sandy clay loam.	CL	A-6	0	75-100	75-100	65-100	50-80	30-40	10-20
	11	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
61, 62	0-5	Fine sandy loam	SM, ML	A-4, A-2	0	80-100	75-100	60-85	30-55	10-20	NP-5
Stoneham	5-8	Clay loam, sandy clay loam, loam.	CL, SC, CL-ML, SM-SC	A-6, A-4	0	95-100	90-100	80-100	35-80	25-35	5-15
	8-14	Loam, clay loam	CL, SC, SM-SC, CL-ML	A-4, A-6	0	95-100	75-100	60-95	45-75	15-30	5-15
	14-60	Sandy loam, gravelly sandy loam.	SM, GM	A-2, A-4	0-5	65-100	60-100	50-85	15-50	---	NP

See footnote at end of table.

TABLE 8.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
63----------	0-7	Loamy fine sand	SM	A-2	0	95-100	90-100	65-95	15-30	---	NP
Tassel	7-19	Fine sandy loam, loamy very fine sand.	ML, SM	A-4	0	95-100	90-100	75-95	40-65	20-25	NP-5
	19	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
64, 65----------	0-5	Sandy loam-------	SM, ML	A-2, A-4	0-5	75-100	75-100	70-90	30-60	---	NP
Terry	5-17	Fine sandy loam, sandy loam.	SM, ML	A-4	0	75-100	75-100	70-85	40-60	---	NP
	17-32	Fine sandy loam, sandy loam, loamy sand.	SM	A-2, A-4	0-5	75-100	75-100	70-85	25-50	---	NP
	32	Weathered bedrock	---	---	---	---	---	---	---	---	---
66*:											
Thedalund-------	0-3	Loam----------	CL-ML, CL, SM-SC, SC	A-4	0-5	80-100	75-100	70-95	40-75	20-30	5-10
	3-25	Clay loam, loam, very fine sandy loam.	CL-ML, CL, SM-SC, SC	A-6, A-4	0-5	80-100	75-100	70-95	40-80	25-35	5-15
	25	Weathered bedrock	---	---	---	---	---	---	---	---	---
Keota-----------	0-4	Loam----------	ML	A-4	0	95-100	95-100	85-95	60-80	25-35	NP-10
	4-35	Silt loam, loam	ML	A-4	0	95-100	95-100	85-95	85-95	25-40	NP-10
	35	Weathered bedrock	---	---	---	---	---	---	---	---	---
67*:											
Thedalund-------	0-3	Loam----------	CL-ML, CL, SM-SC, SC	A-4	0-5	80-100	75-100	70-95	40-75	20-30	5-10
	3-24	Clay loam, loam, very fine sandy loam.	CL-ML, CL, SM-SC, SC	A-6, A-4	0-5	80-100	75-100	70-95	40-80	25-35	5-15
	24	Weathered bedrock	---	---	---	---	---	---	---	---	---
Keota-----------	0-4	Loam----------	ML	A-4	0	95-100	95-100	85-95	60-80	25-35	NP-10
	4-35	Silt loam, loam	ML	A-4	0	95-100	95-100	85-95	85-95	25-40	NP-10
	35	Weathered bedrock	---	---	---	---	---	---	---	---	---
68----------	0-7	Fine sandy loam	SM, ML	A-4, A-2	0	75-100	75-100	55-95	25-65	15-25	NP-5
Treon	7-11	Fine sandy loam, sandy loam.	SM, ML	A-4, A-2	0	75-100	75-100	55-95	25-65	15-25	NP-5
	11	Weathered bedrock	---	---	---	---	---	---	---	---	---
69*:											
Treon-----------	0-7	Fine sandy loam	SM, ML	A-4, A-2	0	75-100	75-100	55-95	25-65	15-25	NP-5
	7-11	Fine sandy loam, sandy loam.	SM, ML	A-4, A-2	0	75-100	75-100	55-95	25-65	15-25	NP-5
	11	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop.											
70*:											
Ustic Torriorthents.											
Rock outcrop.											
71, 72----------	0-2	Loamy sand-------	SM	A-2	0	100	90-100	60-90	15-30	---	NP
Vona	2-20	Fine sandy loam, sandy loam.	SM	A-2, A-4	0	100	90-100	60-90	30-45	---	NP
	20-60	Sandy loam, loamy sand.	SM	A-2	0	100	90-100	50-85	15-30	---	NP

See footnote at end of table.

TABLE 8.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
73, 74----------	0-6	Sandy loam-------	SM	A-2, A-4	0	100	90-100	60-90	30-45	---	NP
Vona	6-15	Fine sandy loam, sandy loam.	SM	A-2, A-4	0	100	90-100	60-90	30-45	---	NP
	15-60	Sandy loam, loamy sand.	SM	A-2	0	100	90-100	50-85	15-30	---	NP
75----------	0-4	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4, A-2	0	90-100	75-100	60-85	30-65	15-25	NP-5
Wages	4-14	Clay loam, sandy clay loam, loam.	CL, SC	A-6	0	95-100	90-100	75-95	35-75	25-40	15-25
	14-60	Loam, fine sandy loam, sandy clay loam.	CL, CL-ML, SC, SM-SC	A-4, A-6	0	95-100	75-100	60-95	35-70	15-30	5-15
76----------	0-4	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4, A-2	0	90-100	75-100	60-85	30-65	15-25	NP-5
Wages	4-12	Clay loam, sandy clay loam, loam.	CL, SC	A-6	0	95-100	90-100	75-95	35-75	25-40	15-25
	12-60	Loam, fine sandy loam, sandy clay loam.	CL, CL-ML, SC, SM-SC	A-4, A-6	0	95-100	75-100	60-95	35-70	15-30	5-15
77----------	0-9	Loam----------	ML, CL-ML	A-4	0	100	95-100	85-100	60-85	20-30	NP-10
Weld	9-18	Clay loam, silty clay, clay.	CL	A-6, A-7	0	100	100	95-100	85-95	35-50	15-30
	18-22	Silt loam, loam, silty clay loam.	CL-ML, CL	A-4, A-6	0	100	95-100	85-100	70-95	20-35	5-15
	22-60	Silt loam, loam, sandy loam.	ML, CL-ML, SM, SM-SC	A-4	0	100	75-100	60-100	35-85	20-30	NP-10

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	G/cm³	In/hr	In/in	pH	Mmhos/cm					Pct
1----------	0-6	15-20	1.30-1.50	2.0-6.0	0.16-0.18	6.1-7.3	<2	Low-------	0.20	4	3	1-2
Altvan	6-27	20-35	1.20-1.50	0.6-2.0	0.15-0.17	6.6-8.4	<2	Moderate	0.32			
	27-60	0-5	1.50-1.70	>20	0.02-0.04	7.4-9.0	<2	Low-------	0.10			
2----------	0-3	15-20	1.30-1.50	2.0-6.0	0.16-0.18	6.1-7.3	<2	Low-------	0.20	4	3	1-2
Altvan	3-23	20-35	1.20-1.50	0.6-2.0	0.15-0.17	6.6-8.4	<2	Moderate	0.32			
	23-60	0-5	1.50-1.70	>20	0.02-0.04	7.4-9.0	<2	Low-------	0.10			
3*:												
Argiustolls.												
Rock outcrop.												
4----------	0-8	5-15	---	2.0-6.0	0.11-0.16	6.6-7.8	<2	Low-------	0.17	5	3	1-2
Ascalon	8-22	20-30	---	0.6-2.0	0.13-0.15	6.6-7.8	<2	Moderate	0.20			
	22-60	3-12	---	2.0-6.0	0.06-0.13	7.9-9.0	<2	Low-------	0.17			
5----------	0-6	5-15	---	2.0-6.0	0.11-0.16	6.6-7.8	<2	Low-------	0.17	5	3	1-2
Ascalon	6-21	20-30	---	0.6-2.0	0.13-0.15	6.6-7.8	<2	Moderate	0.20			
	21-60	3-12	---	2.0-6.0	0.06-0.13	7.9-9.0	<2	Low-------	0.17			
6*:												
Ascalon---------	0-8	5-15	---	2.0-6.0	0.11-0.16	6.6-7.8	<2	Low-------	0.17	5	3	1-2
	8-26	20-30	---	0.6-2.0	0.13-0.15	6.6-7.8	<2	Moderate	0.20			
	26-60	3-12	---	2.0-6.0	0.06-0.13	7.9-9.0	<2	Low-------	0.17			
Blakeland-------	0-15	3-8	---	6.0-20	0.06-0.09	6.1-7.3	<2	Low-------	0.10	5	2	2-4
	15-60	2-5	---	6.0-20	0.05-0.08	6.6-7.3	<2	Low-------	0.10			
7*, 8*:												
Ascalon---------	0-8	5-15	---	2.0-6.0	0.11-0.16	6.6-7.8	<2	Low-------	0.17	5	3	1-2
	8-26	20-30	---	0.6-2.0	0.13-0.15	6.6-7.8	<2	Moderate	0.20			
	26-60	3-12	---	2.0-6.0	0.06-0.13	7.9-9.0	<2	Low-------	0.17			
Bushman---------	0-10	10-18	---	2.0-6.0	0.13-0.15	7.4-8.4	<2	Low-------	0.10	5	3	1-2
	10-60	10-18	---	2.0-6.0	0.15-0.17	7.4-8.4	<4	Low-------	0.10			
Curabith--------	0-10	19-22	---	0.6-2.0	0.13-0.19	7.4-8.4	<2	Low-------	0.20	3	6	<1
	10-25	8-18	---	2.0-6.0	0.05-0.09	7.9-9.0	<2	Low-------	0.15			
	25-42	10-18	---	2.0-6.0	0.09-0.12	7.9-9.0	<2	Low-------	0.15			
	42-60	10-12	---	6.0-20	0.02-0.06	7.9-9.0	<2	Low-------	0.10			
9----------	0-3	10-20	---	0.6-2.0	0.09-0.14	7.4-9.0	2-4	Low-------	0.20	5	3	.5-1
Avar	3-8	35-50	---	<0.06	0.10-0.11	>8.4	2-8	High------	0.24			
	8-60	15-35	---	0.6-2.0	0.09-0.12	>8.4	8-16	Low-------	0.20			
10*:												
Avar----------	0-3	10-20	---	0.6-2.0	0.09-0.14	7.4-9.0	2-4	Low-------	0.20	5	3	.5-1
	3-8	35-50	---	<0.06	0.10-0.11	>8.4	2-8	High------	0.24			
	8-60	15-35	---	0.6-2.0	0.09-0.12	>8.4	8-16	Low-------	0.20			
Manzanola-------	0-3	27-35	---	0.2-2.0	0.19-0.20	7.4-8.4	<4	Moderate	0.24	5	4L	1-2
	3-60	35-45	---	0.06-0.2	0.15-0.18	7.4-8.4	<2	High------	0.28			
11*.												
Badland												
12----------	0-6	2-10	---	6.0-20	0.05-0.08	7.4-8.4	<2	Low-------	0.10	5	2	.5-1
Bankard	6-34	2-10	---	6.0-20	0.05-0.08	7.4-8.4	<2	Low-------	0.10			
	34-60	2-10	---	>20	0.05-0.06	7.4-9.0	<2	Low-------	0.10			
13----------	0-15	3-8	---	6.0-20	0.06-0.09	6.1-7.3	<2	Low-------	0.10	5	2	2-4
Blakeland	15-60	2-5	---	6.0-20	0.05-0.08	6.6-7.3	<2	Low-------	0.10			

See footnote at end of table.

TABLE 9.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	G/cm³	In/hr	In/in	pH	Mmhos/cm					Pct
14----------	0-12	3-8	---	6.0-20	0.06-0.09	6.1-7.3	<2	Low--------	0.10	5	2	2-4
Blakeland	12-60	2-5	---	6.0-20	0.05-0.08	6.6-7.8	<2	Low--------	0.10			
15----------	0-15	8-20	---	0.6-6.0	0.11-0.13	6.1-7.3	<2	Low--------	0.17	5	3	2-4
Bresser	15-37	20-30	---	0.6-2.0	0.15-0.18	6.1-7.8	<2	Moderate	0.20			
	37-60	3-10	---	2.0-20	0.05-0.08	6.6-7.8	<2	Low--------	0.10			
16----------	0-15	8-20	---	0.6-6.0	0.11-0.13	6.1-7.3	<2	Low--------	0.17	5	3	2-4
Bresser	15-34	20-30	---	0.6-2.0	0.15-0.18	6.1-7.8	<2	Moderate	0.20			
	34-60	3-10	---	2.0-20	0.05-0.08	6.6-7.8	<2	Low--------	0.10			
17----------	0-10	10-18	---	2.0-6.0	0.13-0.15	7.4-8.4	<2	Low--------	0.10	5	3	1-2
Bushman	10-60	10-18	---	2.0-6.0	0.15-0.17	7.4-8.4	<4	Low--------	0.10			
18----------	0-6	10-18	---	2.0-6.0	0.13-0.15	7.4-8.4	<2	Low--------	0.10	5	3	1-2
Bushman	6-60	10-18	---	2.0-6.0	0.15-0.17	7.4-8.4	<4	Low--------	0.10			
19*:												
Bushman---------	0-6	10-18	---	2.0-6.0	0.13-0.15	7.4-8.4	<2	Low--------	0.10	5	3	1-2
	6-60	10-18	---	2.0-6.0	0.15-0.17	7.4-8.4	<4	Low--------	0.10			
Curabith--------	0-10	19-22	---	0.6-2.0	0.13-0.19	7.4-8.4	<2	Low--------	0.20	3	6	<1
	10-25	8-18	---	2.0-6.0	0.05-0.09	7.9-9.0	<2	Low--------	0.15			
	25-42	10-20	---	2.0-6.0	0.09-0.12	7.9-9.0	<2	Low--------	0.15			
	42-60	10-12	---	6.0-20	0.02-0.06	7.9-9.0	<2	Low--------	0.10			
Canyon----------	0-3	10-20	1.20-1.40	0.6-2.0	0.15-0.18	7.4-8.4	<2	Low--------	0.24	2	8	.5-1
	3-14	10-25	1.30-1.50	0.6-2.0	0.13-0.18	7.4-8.4	<2	Low--------	0.43			
	14	---	---	---	---	---	---	----------	----			
20----------	0-3	5-15	---	2.0-6.0	0.07-0.11	7.4-8.4	<2	Low--------	0.17	5	8	.5-1
Cascajo	3-24	0-15	---	6.0-20	0.05-0.08	7.4-8.4	<2	Low--------	0.10			
	24-60	0-5	---	6.0-20	0.05-0.06	7.4-8.4	<2	Low--------	0.10			
21, 22----------	0-10	10-20	---	2.0-6.0	0.13-0.15	6.6-7.8	<2	Low--------	0.37	2	5	>2
Cushman	10-29	25-35	---	0.6-2.0	0.14-0.18	6.6-8.4	<2	Moderate	0.32			
	29	---	---	---	---	---	---	----------	----			
23----------	0-4	27-40	---	0.2-0.6	0.19-0.21	6.6-7.8	<2	Moderate	0.24	3	6	2-4
Dacono	4-21	35-60	---	0.2-0.6	0.15-0.21	6.6-8.4	<2	High-------	0.24			
	21-26	15-35	---	0.6-2.0	0.13-0.18	7.4-8.4	<2	Moderate	0.28			
	26-60	0-5	---	>20	0.05-0.07	7.4-8.4	<2	Low--------	0.17			
24----------	0-9	20-25	---	0.6-2.0	0.16-0.18	6.6-7.3	<2	Low--------	0.15	5	3	2-3
Eckley	9-15	20-35	---	0.6-2.0	0.13-0.16	6.6-7.3	<2	Moderate	0.15			
	15-60	0-5	---	>6.0	0.03-0.06	6.6-7.8	<2	Low--------	0.10			
25----------	0-8	15-25	---	0.6-2.0	0.16-0.18	6.6-7.3	<2	Low--------	0.15	5	3	2-3
Eckley	8-14	20-35	---	0.6-2.0	0.13-0.16	6.6-7.3	<2	Moderate	0.15			
	14-60	0-5	---	>6.0	0.03-0.06	6.6-7.8	<2	Low--------	0.10			
26*:												
Eckley----------	0-8	20-25	---	0.6-2.0	0.16-0.18	6.6-7.3	<2	Low--------	0.15	5	3	2-3
	8-14	20-35	---	0.6-2.0	0.13-0.16	6.6-7.3	<2	Moderate	0.15			
	14-60	0-5	---	>6.0	0.03-0.06	6.6-7.8	<2	Low--------	0.10			
Dix----------	0-12	7-18	1.50-1.70	0.6-6.0	0.13-0.22	6.1-7.8	<2	Low--------	0.17	2	3	1-2
	12-37	2-10	1.70-1.90	6.0-20	0.04-0.06	6.6-7.8	<2	Low--------	0.10			
	37-60	0-3	1.70-2.00	>20	0.02-0.04	6.6-7.8	<2	Low--------	0.10			
Blakeland-------	0-12	3-8	---	6.0-20	0.06-0.09	6.1-7.3	<2	Low--------	0.10	5	2	2-4
	12-60	2-5	---	6.0-20	0.05-0.08	6.6-7.8	<2	Low--------	0.10			
27----------	0-3	10-20	1.20-1.40	0.6-2.0	0.21-0.23	6.6-8.4	<2	Low--------	0.43	2	4L	.5-1
Epping	3-17	10-20	1.20-1.40	0.6-2.0	0.18-0.20	7.4-8.4	<2	Low--------	0.43			
	17	---	---	---	---	---	---	----------	----			
28*:												
Haplaquolls.												

See footnote at end of table.

TABLE 9.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	G/cm³	In/hr	In/in	pH	Mmhos/cm					Pct
28*:												
Fluvaquents.												
29	0-12	10-27	---	0.6-2.0	0.14-0.18	7.4-8.4	<8	Low	0.24	5	4L	.5-2
Haverson	12-60	18-35	---	0.6-2.0	0.14-0.18	7.4-9.0	<8	Low	0.24			
30	0-4	15-25	1.20-1.30	0.6-2.0	0.20-0.24	6.1-7.3	<2	Low	0.32	5	6	1-3
Keith	4-20	20-35	1.10-1.20	0.6-2.0	0.18-0.22	6.6-8.4	<2	Moderate	0.32			
	20-60	10-20	1.30-1.40	0.6-2.0	0.20-0.22	7.4-8.4	<2	Low	0.43			
31*, 32*:												
Kim	0-3	15-27	---	0.6-2.0	0.16-0.18	7.4-8.4	<2	Low	0.32	5	4L	.5-1
	3-60	18-35	---	0.6-2.0	0.15-0.17	7.9-8.4	<8	Moderate	0.32			
Mitchell	0-7	15-27	1.20-1.40	0.6-2.0	0.22-0.24	7.4-8.4	<2	Low	0.43	5	4L	.5-1
	7-60	8-18	1.20-1.40	0.6-2.0	0.17-0.22	7.4-8.4	<2	Low	0.43			
33*:												
Kim	0-3	15-27	---	0.6-2.0	0.16-0.18	7.4-8.4	<2	Low	0.32	5	4L	.5-1
	3-60	18-35	---	0.6-2.0	0.15-0.17	7.9-8.4	<8	Moderate	0.32			
Shingle	0-4	27-35	---	0.6-2.0	0.19-0.21	7.4-9.0	<2	Moderate	0.32	2	4L	<1
	4-11	20-35	---	0.6-2.0	0.16-0.21	7.4-9.0	<2	Moderate	0.49			
	11	---	---	---	---	---	---	---	---			
34, 35	0-3	10-20	---	2.0-6.0	0.12-0.16	6.6-7.8	<2	Low	0.15	5	3	2-4
Manter	3-28	9-18	---	2.0-6.0	0.11-0.14	6.6-7.8	<2	Low	0.15			
	28-60	5-15	---	2.0-6.0	0.08-0.14	7.9-8.4	<2	Low	0.15			
36	0-3	20-35	---	0.2-2.0	0.19-0.20	7.4-8.4	<4	Moderate	0.24	5	4L	1-2
Manzanola	3-48	35-45	---	0.06-0.2	0.15-0.18	7.4-8.4	<2	High	0.28			
	48-60	30-40	---	0.2-0.6	0.16-0.18	7.4-9.0	<8	Moderate	0.24			
37	0-3	30-40	---	0.2-0.6	0.14-0.18	6.6-8.4	2-4	Moderate	0.43	1	4L	.5-2
Midway	3-11	35-45	---	0.06-0.2	0.14-0.18	7.9-9.0	2-8	High	0.43			
	11	---	---	---	---	---	---	---	---			
38, 39	0-4	15-25	---	0.6-2.0	0.13-0.18	6.6-8.4	<2	Low	0.28	5	4L	1-2
Nucla	4-60	18-35	---	0.6-2.0	0.16-0.18	7.4-8.4	<2	Moderate	0.32			
40	0-7	15-25	---	0.2-2.0	0.15-0.20	6.1-7.8	<2	Moderate	0.24	5	6	2-4
Nunn	7-23	35-45	---	0.06-0.2	0.15-0.18	6.6-8.4	<2	High	0.28			
	23-60	25-40	---	0.2-0.6	0.10-0.18	7.4-8.4	<2	Moderate	0.24			
41	0-8	27-35	---	0.2-2.0	0.15-0.20	6.1-7.8	<2	Moderate	0.24	5	6	2-4
Nunn	8-22	35-45	---	0.06-0.2	0.15-0.18	6.6-8.4	<2	High	0.28			
	22-60	25-40	---	0.2-0.6	0.10-0.18	7.4-8.4	<2	Moderate	0.24			
42	0-5	5-10	---	6.0-20.0	0.06-0.10	6.6-7.8	<2	Low	0.15	5	2	.5-1
Olney	5-34	18-30	---	0.6-2.0	0.13-0.15	6.6-7.8	<2	Moderate	0.24			
	34-60	15-30	---	0.6-2.0	0.11-0.15	7.9-8.4	<2	Low	0.24			
43	0-4	5-10	---	6.0-20.0	0.06-0.10	6.6-7.8	<2	Low	0.15	5	2	.5-1
Olney	4-31	18-30	---	0.6-2.0	0.13-0.15	6.6-7.8	<2	Moderate	0.24			
	31-60	15-30	---	0.6-2.0	0.11-0.15	7.9-8.4	<2	Low	0.24			
44, 45	0-6	10-20	---	0.6-6.0	0.11-0.15	6.6-7.8	<2	Low	0.20	5	3	1-2
Olney	6-18	18-30	---	0.6-2.0	0.13-0.15	6.6-7.8	<2	Low	0.24			
	18-60	15-30	---	0.6-6.0	0.11-0.15	7.9-8.4	<2	Low	0.24			
46, 47	0-5	10-20	---	2.0-6.0	0.11-0.13	7.4-8.4	<2	Low	0.20	5	3	.5-2
Otero	5-60	5-18	---	2.0-6.0	0.08-0.12	7.4-8.4	<4	Low	0.17			
48*:												
Otero	0-5	10-20	---	2.0-6.0	0.11-0.13	7.4-8.4	<2	Low	0.20	5	3	.5-2
	5-60	5-18	---	2.0-6.0	0.08-0.12	7.4-8.4	<4	Low	0.17			

See footnote at end of table.

TABLE 9.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	G/cm³	In/hr	In/in	pH	Mmhos/cm					Pct
48*:												
Tassel	0-7	2-8	1.60-1.80	6.0-20	0.10-0.12	7.4-8.4	<2	Low	0.17	2	2	.5-1
	7-19	5-12	1.50-1.75	2.0-6.0	0.15-0.17	7.4-8.4	<2	Low	0.24			
	19	---	---	---	---	---	---	---	---			
49	0-15	10-20	---	2.0-6.0	0.14-0.17	6.6-7.8	<2	Low	0.17	5	3	2-4
Paoli	15-45	8-18	---	6.0-20	0.14-0.17	7.4-7.8	<2	Low	0.20			
	45-60	8-18	---	6.0-20	0.12-0.14	7.4-8.4	<2	Low	0.20			
50	0-13	10-20	---	2.0-6.0	0.14-0.17	6.6-7.8	<2	Low	0.17	5	3	2-4
Paoli	13-45	8-18	---	6.0-20	0.14-0.17	7.4-7.8	<2	Low	0.20			
	45-60	8-18	---	6.0-20	0.12-0.14	7.4-8.4	<2	Low	0.20			
51	0-4	5-10	---	2.0-6.0	0.07-0.10	6.6-7.8	<2	Low	0.17	5	8	2-4
Peetz	4-60	0-8	---	6.0-20	0.03-0.06	7.4-8.4	<2	Low	0.10			
52*:												
Peetz	0-4	5-10	---	2.0-6.0	0.07-0.10	6.6-7.8	<2	Low	0.17	5	8	2-4
	4-60	0-8	---	6.0-20	0.03-0.06	7.4-8.4	<2	Low	0.10			
Altvan	0-3	15-20	1.30-1.50	2.0-6.0	0.16-0.18	6.1-7.3	<2	Low	0.20	4	3	1-2
	3-23	20-35	1.20-1.50	0.6-2.0	0.15-0.17	6.6-8.4	<2	Moderate	0.32			
	23-60	0-5	1.50-1.70	>20	0.02-0.04	7.4-9.0	<2	Low	0.10			
53*:												
Peetz	0-4	5-10	---	2.0-6.0	0.07-0.10	6.6-7.8	<2	Low	0.17	5	8	2-4
	4-60	0-8	---	6.0-20	0.03-0.06	7.4-8.4	<2	Low	0.10			
Rock outcrop.												
54	0-4	15-20	---	0.6-2.0	0.16-0.18	6.6-7.3	<2	Low	0.24	5	4	2-4
Platner	4-24	35-50	---	0.06-0.2	0.16-0.20	7.4-7.8	<2	High	0.20			
	24-60	10-20	---	0.6-6.0	0.09-0.16	7.9-8.4	<2	Low	0.28			
55	0-5	8-18	---	2.0-6.0	0.13-0.15	6.6-7.8	<2	Low	0.28	3	3	.5-1
Renohill	5-18	35-45	---	0.06-0.2	0.14-0.16	6.6-8.4	<2	High	0.32			
	18-32	30-40	---	0.2-0.6	0.19-0.21	7.9-9.0	<4	Moderate	0.37			
	32	---	---	---	---	---	---	---	---			
56	0-4	8-18	---	2.0-6.0	0.13-0.15	6.6-7.8	<2	Low	0.28	3	3	.5-1
Renohill	4-17	35-45	---	0.06-0.2	0.14-0.16	6.6-8.4	<2	High	0.32			
	17-29	30-40	---	0.2-0.6	0.19-0.21	7.9-9.0	<4	Moderate	0.37			
	29	---	---	---	---	---	---	---	---			
57*:												
Renohill	0-4	8-18	---	2.0-6.0	0.13-0.15	6.6-7.8	<2	Low	0.28	3	3	.5-1
	4-13	35-45	---	0.06-0.2	0.14-0.16	6.6-8.4	<2	High	0.32			
	13-29	30-40	---	0.2-0.6	0.19-0.21	7.9-9.0	<4	Moderate	0.37			
	29	---	---	---	---	---	---	---	---			
Shingle	0-4	27-35	---	0.6-2.0	0.19-0.21	7.4-9.0	<2	Moderate	0.32	2	4L	<1
	4-11	20-35	---	0.6-2.0	0.16-0.21	7.4-9.0	<2	Moderate	0.49			
	11	---	---	---	---	---	---	---	---			
58	0-5	8-20	1.30-1.50	2.0-6.0	0.16-0.18	6.6-8.4	<2	Low	0.20	4	3	1-2
Rosebud	5-19	23-35	1.15-1.30	0.6-2.0	0.15-0.17	6.6-7.8	<2	Moderate	0.28			
	19-38	15-26	1.30-1.50	0.6-2.0	0.11-0.17	7.4-8.4	<2	Low	0.28			
	38	---	---	---	---	---	---	---	---			
59	0-4	8-20	1.30-1.50	2.0-6.0	0.16-0.18	6.6-8.4	<2	Low	0.20	4	3	1-2
Rosebud	4-16	23-35	1.15-1.30	0.6-2.0	0.15-0.17	6.6-8.4	<2	Moderate	0.28			
	16-28	15-26	1.30-1.50	0.6-2.0	0.11-0.17	7.4-8.4	<2	Low	0.28			
	28	---	---	---	---	---	---	---	---			
60	0-4	27-35	---	0.6-2.0	0.19-0.21	7.4-9.0	<2	Moderate	0.32	2	4L	<1
Shingle	4-11	20-35	---	0.6-2.0	0.16-0.21	7.9-9.0	<2	Moderate	0.49			
	11	---	---	---	---	---	---	---	---			

See footnote at end of table.

TABLE 9.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Wind erodibility group	Organic matter
									K	T		
	In	Pct	G/cm³	In/hr	In/in	pH	Mmhos/cm					Pct
61, 62	0-5	10-20	---	2.0-6.0	0.11-0.15	6.6-7.8	<2	Low	0.17	5	3	.5-1
Stoneham	5-8	20-35	---	0.6-2.0	0.14-0.18	6.6-7.4	<2	Moderate	0.24			
	8-14	20-35	---	0.6-2.0	0.14-0.18	7.9-8.4	<2	Moderate	0.24			
	14-60	---	---	2.0-6.0	0.08-0.12	7.9-9.0	<2	Low	0.17			
63	0-7	2-8	1.60-1.80	6.0-20	0.10-0.12	7.4-8.4	<2	Low	0.17	2	2	.5-1
Tassel	7-19	5-12	1.50-1.75	2.0-6.0	0.15-0.17	7.4-8.4	<2	Low	0.24			
	19	---	---	---	---	---	---	---	---			
64, 65	0-5	10-20	---	2.0-6.0	0.13-0.15	7.4-7.8	<2	Low	0.20	2	3	.5-2
Terry	5-17	9-18	---	2.0-6.0	0.13-0.15	6.6-7.8	<2	Low	0.20			
	17-32	5-17	---	2.0-6.0	0.13-0.15	7.9-9.0	<2	Low	0.20			
	32	---	---	---	---	---	---	---	---			
66*:												
Thedalund	0-3	15-25	---	0.6-2.0	0.16-0.18	7.9-8.4	<2	Low	0.32	2	4L	.5-2
	3-25	18-35	---	0.6-2.0	0.16-0.18	7.4-8.4	<8	Moderate	0.37			
	25	---	---	---	---	---	---	---	---			
Keota	0-4	5-20	---	0.6-2.0	0.16-0.18	7.4-8.4	<2	Low	0.37	2	4L	.5-1
	4-35	5-18	---	0.6-2.0	0.14-0.16	7.9-9.0	<2	Low	0.43			
	35	---	---	---	---	---	---	---	---			
67*:												
Thedalund	0-3	15-25	---	0.6-2.0	0.16-0.18	7.9-8.4	<2	Low	0.32	2	4L	.5-2
	3-24	18-35	---	0.6-2.0	0.16-0.18	7.4-9.0	<8	Moderate	0.37			
	24	---	---	---	---	---	---	---	---			
Keota	0-4	5-20	---	0.6-2.0	0.16-0.18	7.4-8.4	<2	Low	0.37	2	4L	.5-1
	4-35	5-18	---	0.6-2.0	0.14-0.16	7.9-9.0	<2	Low	0.43			
	35	---	---	---	---	---	---	---	---			
68	0-7	10-20	---	2.0-6.0	0.14-0.16	7.4-8.4	<2	Low	0.28	1	3	2-4
Treon	7-11	10-20	---	2.0-6.0	0.14-0.16	7.4-8.4	<2	Low	0.28			
	11	---	---	---	---	---	---	---	---			
69*:												
Treon	0-7	10-20	---	2.0-6.0	0.14-0.16	7.4-8.4	<2	Low	0.28	1	3	2-4
	7-11	10-20	---	2.0-6.0	0.14-0.16	7.4-8.4	<2	Low	0.28			
	11	---	---	---	---	---	---	---	---			
Rock outcrop.												
70*:												
Ustic Torriorthents.												
Rock outcrop.												
71, 72	0-2	3-8	---	6.0-20	0.09-0.11	6.6-7.8	<2	Low	0.15	5	2	.5-1
Vona	2-20	10-18	---	2.0-6.0	0.12-0.14	6.6-7.8	<4	Low	0.24			
	20-60	3-15	---	6.0-20	0.08-0.11	7.9-9.0	<4	Low	0.20			
73, 74	0-6	5-10	---	2.0-6.0	0.11-0.13	6.6-7.8	<2	Low	0.20	5	3	.5-1
Vona	6-15	10-18	---	2.0-6.0	0.12-0.14	6.6-7.8	<4	Low	0.24			
	15-60	3-15	---	6.0-20	0.08-0.11	7.9-9.0	<4	Low	0.20			
75	0-4	12-20	---	2.0-6.0	0.11-0.15	6.6-7.8	<2	Low	0.20	5	3	1-3
Wages	4-14	18-35	---	0.6-2.0	0.14-0.21	7.4-8.4	<2	Moderate	0.24			
	14-60	15-35	---	0.6-2.0	0.11-0.18	7.9-8.4	<2	Low	0.24			
76	0-4	12-20	---	2.0-6.0	0.11-0.15	6.6-7.8	<2	Low	0.20	5	3	1-3
Wages	4-12	18-35	---	0.6-2.0	0.14-0.21	6.6-7.8	<2	Moderate	0.24			
	12-60	15-35	---	0.6-2.0	0.11-0.18	7.9-8.4	<2	Low	0.24			
77	0-9	15-27	---	0.6-2.0	0.16-0.20	6.6-8.4	<2	Low	0.32	5	6	2-4
Weld	9-18	35-45	---	0.06-0.2	0.18-0.20	6.6-8.4	<2	High	0.28			
	18-22	20-35	---	0.6-2.0	0.16-0.18	7.4-9.0	<2	Moderate	0.28			
	22-60	15-25	---	0.6-2.0	0.12-0.18	7.9-9.0	<2	Low	0.28			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--SOIL AND WATER FEATURES

["Flooding" and terms such as "rare" and "brief" are explained in the text. The symbol > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Hardness		Uncoated steel	Concrete
					In				
1, 2---------- Altvan	B	None--------	---	---	>60	---	Moderate-------	Low------	Low.
3*: Argiustolls.									
Rock outcrop.									
4, 5---------- Ascalon	B	None--------	---	---	>60	---	Moderate-------	High-----	Low.
6*: Ascalon----------	B	None--------	---	---	>60	---	Moderate-------	High-----	Low.
Blakeland--------	A	None--------	---	---	>60	---	Low------------	Low------	Low.
7*, 8*: Ascalon----------	B	None--------	---	---	>60	---	Moderate-------	High-----	Low.
Bushman----------	A	None--------	---	---	>60	---	Low------------	---	Low.
Curabith---------	A	None--------	---	---	>60	---	Low------------	Low------	Low.
9---------- Avar	D	Rare--------	---	---	>60	---	Moderate-------	High-----	Moderate.
10*: Avar----------	D	Rare--------	---	---	>60	---	Moderate-------	High-----	Moderate.
Manzanola--------	C	None--------	---	---	>60	---	Low------------	High-----	Moderate.
11*. Badland									
12---------- Bankard	A	Frequent----	Brief-------	Mar-Jun	>60	---	Low------------	Moderate	Low.
13, 14---------- Blakeland	A	None--------	---	---	>60	---	Low------------	Low------	Low.
15, 16---------- Bresser	B	None--------	---	---	>60	---	Moderate-------	Moderate	Low.
17, 18---------- Bushman	A	None--------	---	---	>60	---	Low------------	---	Low.

See footnote at end of table.

TABLE 10.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Hardness		Uncoated steel	Concrete
					In				
19*:									
Bushman	A	None	---	---	>60	---	Low	---	Low.
Curabith	A	None	---	---	>60	---	Low	Low	Low.
Canyon	D	None	---	---	10-20	Soft	Low	High	Low.
20--Cascajo	A	None	---	---	>60	---	Low	Moderate	Low.
21, 22--Cushman	C	None	---	---	20-40	Soft	Low	High	Low.
23--Dacono	C	None	---	---	>60	---	Low	High	Low.
24, 25--Eckley	B	None	---	---	>60	---	Low	Moderate	Low.
26*:									
Eckley	B	None	---	---	>60	---	Low	Moderate	Low.
Dix	A	None	---	---	>60	---	Low	Low	Low.
Blakeland	A	None	---	---	>60	---	Low	Low	Low.
27--Epping	D	None	---	---	10-20	Soft	Low	High	Low.
28*:									
Haplaquolls.									
Fluvaquents.									
29--Haverson	B	Rare	---	---	>60	---	Low	High	Low.
30--Keith	B	None	---	---	>60	---	Moderate	Moderate	Low.
31*, 32*:									
Kim	B	None	---	---	>60	---	Low	High	Low.
Mitchell	B	None	---	---	>60	---	Low	High	Low.
33*:									
Kim	B	None	---	---	>60	---	Low	High	Low.
Shingle	D	None	---	---	10-20	Soft	Low	High	Low.

See footnote at end of table.

TABLE 10.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Hardness		Uncoated steel	Concrete
					In				
34, 35---------- Manter	B	None--------	---	---	>60	---	Moderate-------	High-----	Low.
36---------- Manzanola	C	None--------	---	---	>60	---	Low----------	High-----	Moderate.
37---------- Midway	D	None--------	---	---	10-20	Soft	Low----------	High-----	Low.
38, 39---------- Nucla	B	None--------	---	---	>60	---	Moderate-------	High-----	Low.
40, 41---------- Nunn	C	None--------	---	---	>60	---	Moderate-------	High-----	Low.
42, 43, 44, 45---- Olney	B	None--------	---	---	>60	---	Low----------	High-----	Low.
46, 47---------- Otero	B	None--------	---	---	>60	---	Low----------	High-----	Low.
48*: Otero----------	B	None--------	---	---	>60	---	Low----------	High-----	Low.
Tassel----------	D	None--------	---	---	10-20	Soft	Low----------	High-----	Low.
49---------- Paoli	B	None--------	---	---	>60	---	Moderate-------	High-----	Low.
50---------- Paoli	B	None to rare	---	---	>60	---	Moderate-------	High-----	Low.
51---------- Peetz	A	None--------	---	---	>60	---	Low----------	Moderate	Low.
52*: Peetz----------	A	None--------	---	---	>60	---	Low----------	Moderate	Low.
Altvan----------	B	None--------	---	---	>60	---	Moderate-------	Low------	Low.
53*: Peetz----------	A	None--------	---	---	>60	---	Low----------	Moderate	Low.
Rock outcrop.									
54---------- Platner	C	None--------	---	---	>60	---	Low----------	Moderate	Low.
55, 56---------- Renohill	C	None--------	---	---	20-40	Soft	Low----------	High-----	Low.

See footnote at end of table.

TABLE 10.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Hardness		Uncoated steel	Concrete
					In				
57*:									
Renohill	C	None	---	---	20-40	Soft	Low	High	Low.
Shingle	D	None	---	---	10-20	Soft	Low	High	Low.
58, 59---- Rosebud	B	None	---	---	20-40	Soft	Moderate	High	Low.
60---- Shingle	D	None	---	---	10-20	Soft	Low	High	Low.
61, 62---- Stoneham	B	None	---	---	>60	---	Low	High	Low.
63---- Tassel	D	None	---	---	10-20	Soft	Low	High	Low.
64, 65---- Terry	B	None	---	---	20-40	Soft	Low	High	Low.
66*, 67*:									
Thedalund	C	None	---	---	20-40	Soft	Low	High	Low.
Keota	C	None	---	---	20-40	Soft	Low	High	Low.
68---- Treon	D	None	---	---	10-20	Soft	Moderate	High	Low.
69*:									
Treon	D	None	---	---	10-20	Soft	Moderate	High	Low.
Rock outcrop.									
70*:									
Ustic Torriorthents.									
Rock outcrop.									
71, 72, 73, 74---- Vona	B	None	---	---	>60	---	Low	High	Low.
75, 76---- Wages	B	None	---	---	>60	---	Moderate	High	Low.
77---- Weld	C	None	---	---	>60	---	Moderate	High	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Altvan	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Aridic Argiustolls
Ascalon	Fine-loamy, mixed, mesic Aridic Argiustolls
Avar	Fine-loamy, mixed, mesic Ustollic Natrargids
Bankard	Sandy, mixed, mesic Ustic Torrifluvents
Blakeland	Sandy, mixed, mesic Torriorthentic Haplustolls
Bresser	Fine-loamy, mixed, mesic Aridic Argiustolls
Bushman	Coarse-loamy, mixed, mesic Torriorthentic Haplustolls
Canyon	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Cascajo	Sandy-skeletal, mixed, mesic Ustollic Calciorthids
Curabith	Loamy-skeletal, mixed, mesic Aridic Calciustolls
Cushman	Fine-loamy, mixed, mesic Ustollic Haplargids
Dacono	Clayey over sandy or sandy-skeletal, montmorillonitic, mesic Aridic Argiustolls
Dix	Sandy-skeletal, mixed, mesic Torriorthentic Haplustolls
Eckley	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Aridic Argiustolls
Epping	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Haverson	Fine-loamy, mixed (calcareous), mesic Ustic Torrifluvents
Keith	Fine-silty, mixed, mesic Aridic Argiustolls
Keota	Coarse-silty, mixed (calcareous), mesic Ustic Torriorthents
Kim	Fine-loamy, mixed (calcareous), mesic Ustic Torriorthents
Manter	Coarse-loamy, mixed, mesic Aridic Argiustolls
Manzanola	Fine, montmorillonitic, mesic Ustollic Haplargids
Midway	Clayey, montmorillonitic (calcareous), mesic, shallow Ustic Torriorthents
Mitchell	Coarse-silty, mixed (calcareous), mesic Ustic Torriorthents
Nucla	Fine-loamy, mixed, mesic Torriorthentic Haplustolls
Nunn	Fine, montmorillonitic, mesic Aridic Argiustolls
Olney	Fine-loamy, mixed, mesic Ustollic Haplargids
Otero	Coarse-loamy, mixed (calcareous), mesic Ustic Torriorthents
Paoli	Coarse-loamy, mixed, mesic Pachic Haplustolls
Peetz	Sandy-skeletal, mixed, mesic Aridic Calciustolls
Platner	Fine, montmorillonitic, mesic Aridic Paleustolls
Renohill	Fine, montmorillonitic, mesic Ustollic Haplargids
Rosebud	Fine-loamy, mixed, mesic Aridic Argiustolls
Shingle	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Stoneham	Fine-loamy, mixed, mesic Ustollic Haplargids
Tassel	Loamy, mixed (calcareous), mesic, shallow Ustic Torriorthents
Terry	Coarse-loamy, mixed, mesic Ustollic Haplargids
Thedalund	Fine-loamy, mixed (calcareous), mesic Ustic Torriorthents
Treon	Loamy, mixed, mesic, shallow Torriorthentic Haplustolls
Vona	Coarse-loamy, mixed, mesic Ustollic Haplargids
Wages	Fine-loamy, mixed, mesic Aridic Argiustolls
Weld	Fine, montmorillonitic, mesic Aridic Paleustolls

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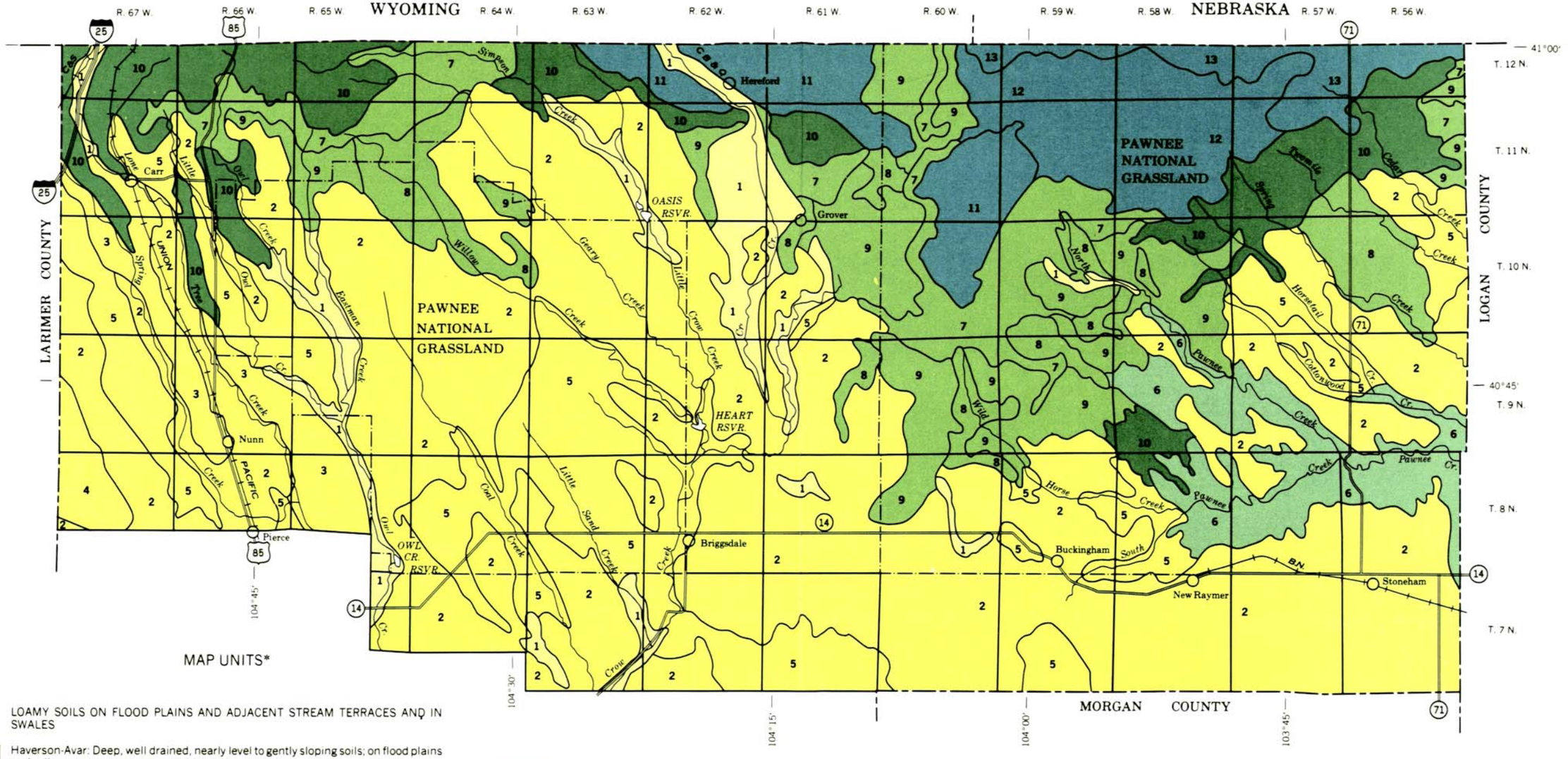


MAP UNITS*

LOAMY SOILS ON FLOOD PLAINS AND ADJACENT STREAM TERRACES AND IN SWALES

1 Haverson-Avar: Deep, well drained, nearly level to gently sloping soils; on flood plains and adjacent stream terraces and in swales

LOAMY SOILS ON PLAINS, ADJACENT STREAM TERRACES, AND UPLAND RIDGES

2 Olney-Ascalon-Platner: Deep, well drained, nearly level to rolling soils; on plains and adjacent stream terraces

3 Altvan-Dacono: Deep, well drained, nearly level to gently undulating soils; on plains and adjacent stream terraces

4 Terry-Otero-Tassel: Shallow to deep, well drained, nearly level to hilly soils; on plains

5 Renohill-Terry-Shingle: Shallow to moderately deep, well drained, nearly level to hilly soils; on plains and upland ridges

LOAMY SOILS ON BREAKS, DISSECTED PLAINS, AND FANS

6 Kim-Otero-Shingle: Shallow to deep, well drained, gently undulating to hilly soils; on breaks, dissected plains, and fans

LOAMY AND GRAVELLY SOILS ON ESCARPMENTS AND ASSOCIATED ALLUVIAL AND COLLUVIAL FANS

7 Argiustolls-Rock outcrop-Ustic Torriorthents: Rock outcrop and shallow to deep, well drained and excessively drained, nearly level to steep soils; on escarpments and colluvial fans

8 Epping-Thedalund-Keota: Shallow to moderately deep, well drained, nearly level to undulating soils; on alluvial and colluvial fans

9 Kim-Stoneham-Mitchell: Deep, well drained, nearly level to sloping soils; on alluvial and colluvial fans

LOAMY AND GRAVELLY SOILS ON RIDGES OF HIGH PLAINS

10 Ascalon-Peetz: Deep, well drained to excessively drained, nearly level to hilly soils; on ridges of high plains

LOAMY SOILS MAINLY ON HIGH PLAINS

11 Ascalon-Altvan: Deep, well drained, nearly level to rolling soils; on high plains

12 Ascalon-Bushman-Curabith: Deep, well drained, nearly level to hilly soils; on high plains and ridges

13 Rosebud-Curabith-Canyon: Shallow to deep, well drained, nearly level to hilly soils; on high plains, ridges, and breaks

* The texture in the descriptive headings refers to the surface layer of the major soils.

Compiled 1981

US DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FOREST SERVICE
COLORADO AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

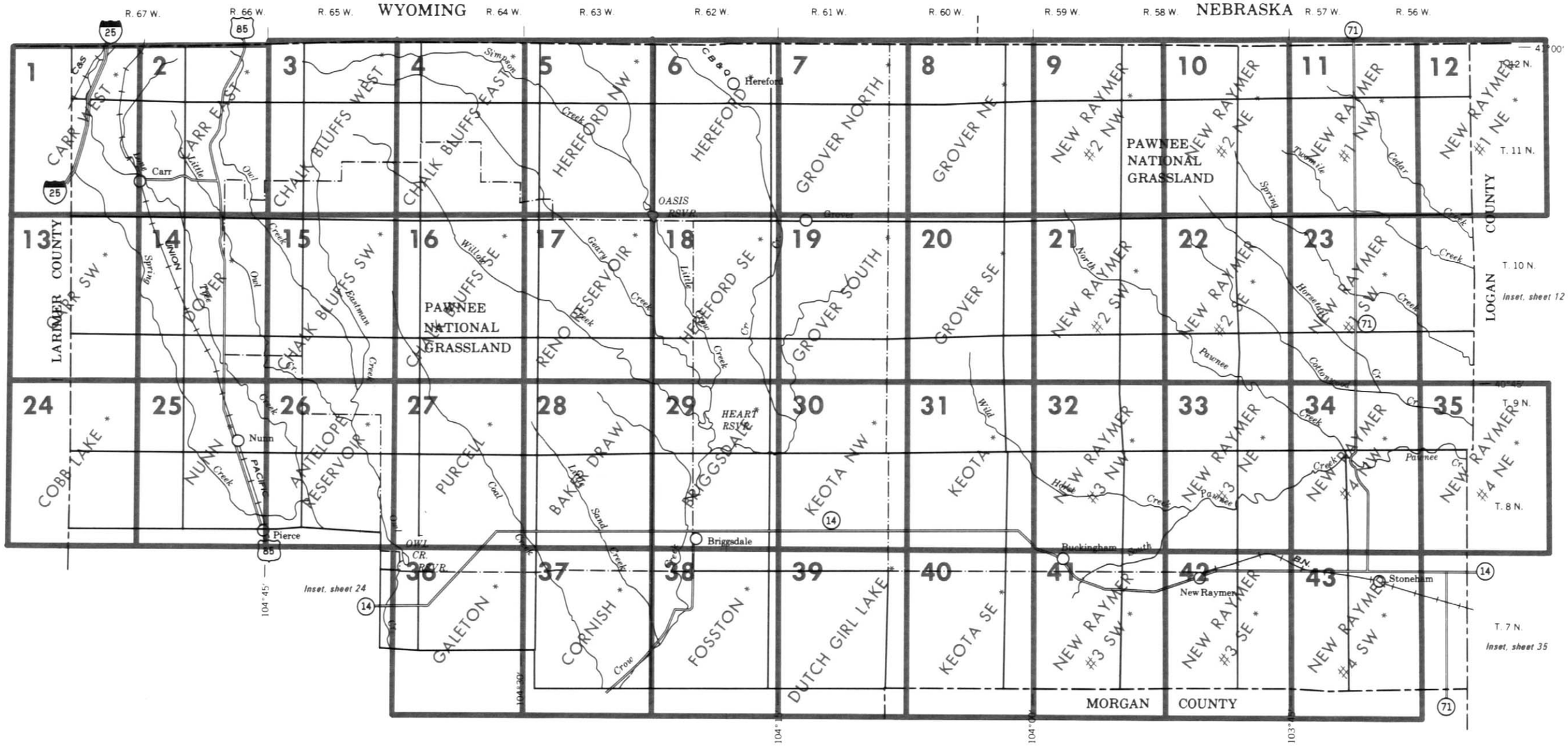
WELD COUNTY, COLORADO, NORTHERN PART

Scale 1: 380,160

1 0 1 2 3 4 5 Miles

N

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



INDEX TO MAP SHEETS

WELD COUNTY, COLORADO, NORTHERN PART

N

Scale 1: 380,160

1 0 1 2 3 4 5 Miles

SOIL LEGEND

SYMBOL	NAME
1	Altvan fine sandy loam, 0 to 6 percent slopes
2	Altvan fine sandy loam, 6 to 9 percent slopes
3	Argiustolls-Rock outcrop complex, 0 to 9 percent slopes
4	Ascalon fine sandy loam, 0 to 6 percent slopes
5	Ascalon fine sandy loam, 6 to 9 percent slopes
6	Ascalon-Blakeland complex, 3 to 15 percent slopes
7	Ascalon-Bushman-Curabith complex, 0 to 3 percent slopes
8	Ascalon-Bushman-Curabith complex, 3 to 15 percent slopes
9	Avar fine sandy loam
10	Avar-Manzanola complex, 0 to 3 percent slopes
11	Badland
12	Bankard loamy fine sand, 0 to 3 percent slopes
13	Blakeland loamy sand, 0 to 6 percent slopes
14	Blakeland loamy sand, 6 to 12 percent slopes
15	Bresser sandy loam, 0 to 3 percent slopes
16	Bresser sandy loam, 3 to 9 percent slopes
17	Bushman fine sandy loam, 0 to 3 percent slopes
18	Bushman fine sandy loam, 3 to 9 percent slopes
19	Bushman-Curabith-Canyon complex, 0 to 20 percent slopes
20	Cascajo gravelly sandy loam, 5 to 20 percent slopes
21	Cushman fine sandy loam, 0 to 6 percent slopes
22	Cushman fine sandy loam, 6 to 9 percent slopes
23	Dacono clay loam, 0 to 6 percent slopes
24	Eckley sandy clay loam, 0 to 6 percent slopes
25	Eckley sandy clay loam, 6 to 9 percent slopes
26	Eckley-Dix-Blakeland complex, 6 to 20 percent slopes
27	Epping silt loam, 0 to 9 percent slopes
28	Haplaquolls-Fluvaquents complex, frequently flooded
29	Haverson loam, 0 to 3 percent slopes
30	Keith loam, 0 to 6 percent slopes
31	Kim-Mitchell complex, 0 to 6 percent slopes
32	Kim-Mitchell complex, 6 to 9 percent slopes
33	Kim-Shingle complex, 6 to 30 percent slopes
34	Manter sandy loam, 0 to 6 percent slopes
35	Manter sandy loam, 6 to 9 percent slopes
36	Manzanola clay loam, 0 to 3 percent slopes
37	Midway clay loam, 0 to 9 percent slopes
38	Nucla loam, 0 to 3 percent slopes
39	Nucla loam, 3 to 9 percent slopes
40	Nunn loam, 0 to 6 percent slopes
41	Nunn clay loam, 0 to 6 percent slopes
42	Olney loamy sand, 0 to 3 percent slopes
43	Olney loamy sand, 3 to 9 percent slopes
44	Olney fine sandy loam, 0 to 6 percent slopes
45	Olney fine sandy loam, 6 to 9 percent slopes
46	Otero sandy loam, 0 to 3 percent slopes
47	Otero sandy loam, 3 to 9 percent slopes
48	Otero-Tassel complex, 6 to 30 percent slopes
49	Paoli fine sandy loam, 0 to 6 percent slopes
50	Paoli fine sandy loam, 6 to 9 percent slopes
51	Peetz gravelly sandy loam, 5 to 20 percent slopes
52	Peetz-Altvan complex, 0 to 20 percent slopes
53	Peetz-Rock outcrop complex, 9 to 40 percent slopes
54	Platner loam, 0 to 3 percent slopes
55	Renohill fine sandy loam, 0 to 6 percent slopes
56	Renohill fine sandy loam, 6 to 9 percent slopes
57	Renohill-Shingle complex, 3 to 9 percent slopes
58	Rosebud fine sandy loam, 0 to 6 percent slopes
59	Rosebud fine sandy loam, 6 to 9 percent slopes
60	Shingle clay loam, 0 to 9 percent slopes
61	Stoneham fine sandy loam, 0 to 6 percent slopes
62	Stoneham fine sandy loam, 6 to 9 percent slopes
63	Tassel loamy fine sand, 5 to 20 percent slopes
64	Terry sandy loam, 0 to 3 percent slopes
65	Terry sandy loam, 3 to 9 percent slopes
66	Thedalund-Keota loams, 0 to 3 percent slopes
67	Thedalund-Keota loams, 3 to 9 percent slopes
68	Treon fine sandy loam, 5 to 20 percent slopes
69	Treon-Rock outcrop complex, 9 to 40 percent slopes
70	Ustic Torriorthents-Rock outcrop complex, 9 to 40 percent slopes
71	Vona loamy sand, 0 to 3 percent slopes
72	Vona loamy sand, 3 to 9 percent slopes
73	Vona sandy loam, 0 to 3 percent slopes
74	Vona sandy loam, 3 to 9 percent slopes
75	Wages fine sandy loam, 0 to 6 percent slopes
76	Wages fine sandy loam, 6 to 9 percent slopes
77	Weld loam, 0 to 6 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool (Davis Airstrip; FLOOD POOL LINE)

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate (79)
- Federal (410)
- State (52)
- County, farm or ranch (378)

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small (water; w)

PITS

- Gravel pit (G.P.)
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) (Indian Mound)
- Located object (label) (Tower)
- Tank (label) (GAS)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) (CANAL)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial (water; w)
- Intermittent (int; i)

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS (SvE 107)

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

SOIL SAMPLE SITE (normally not shown) (S)

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

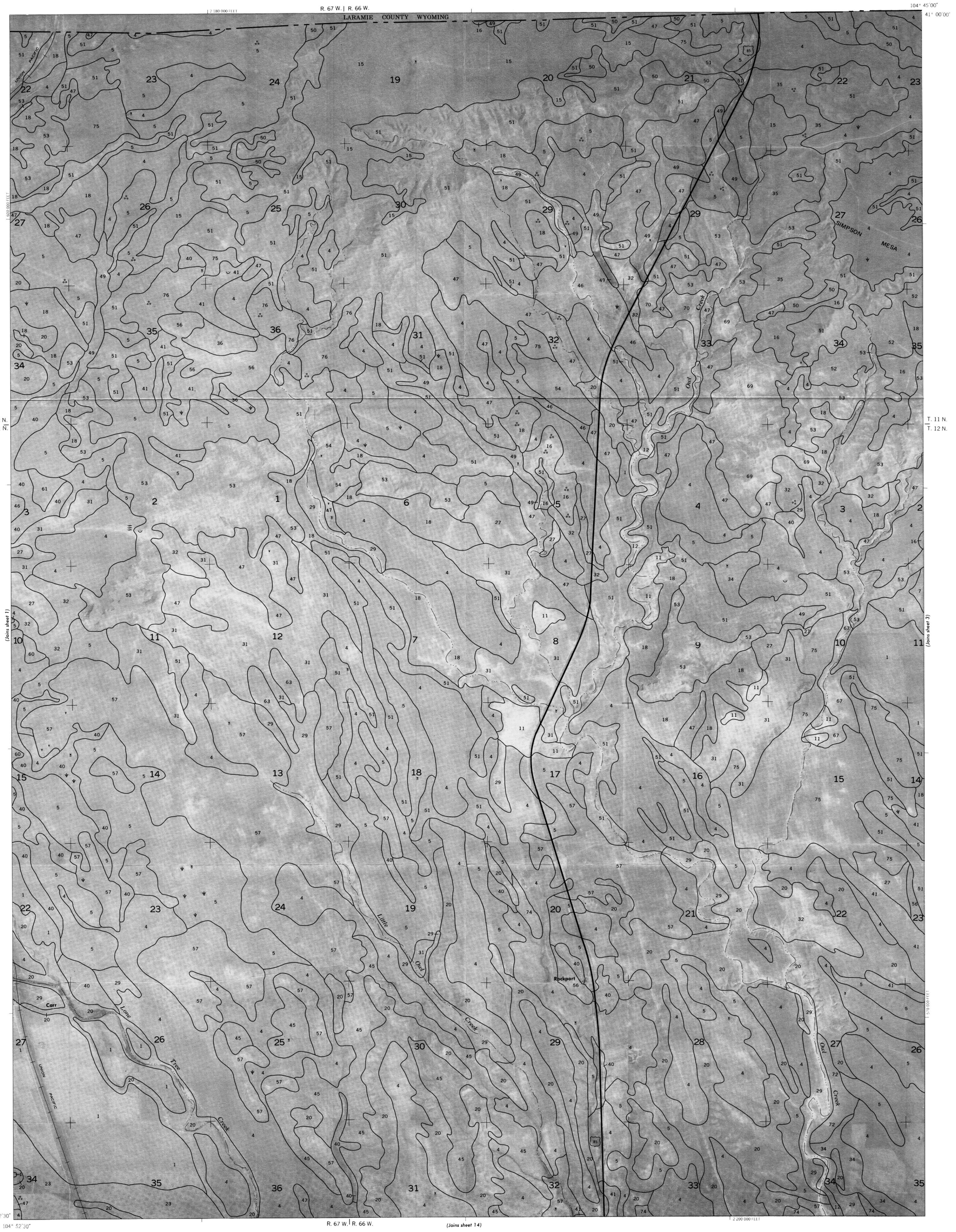
SHEET NO. 1

SOIL SURVEY OF WELD COUNTY, COLORADO, NORTHERN PART

(CARR WEST QUADRANGLE)

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000



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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 3

SOIL SURVEY OF WELD COUNTY, COLORADO, NORTHERN PART

(CHALK BLUFFS WEST QUADRANGLE)

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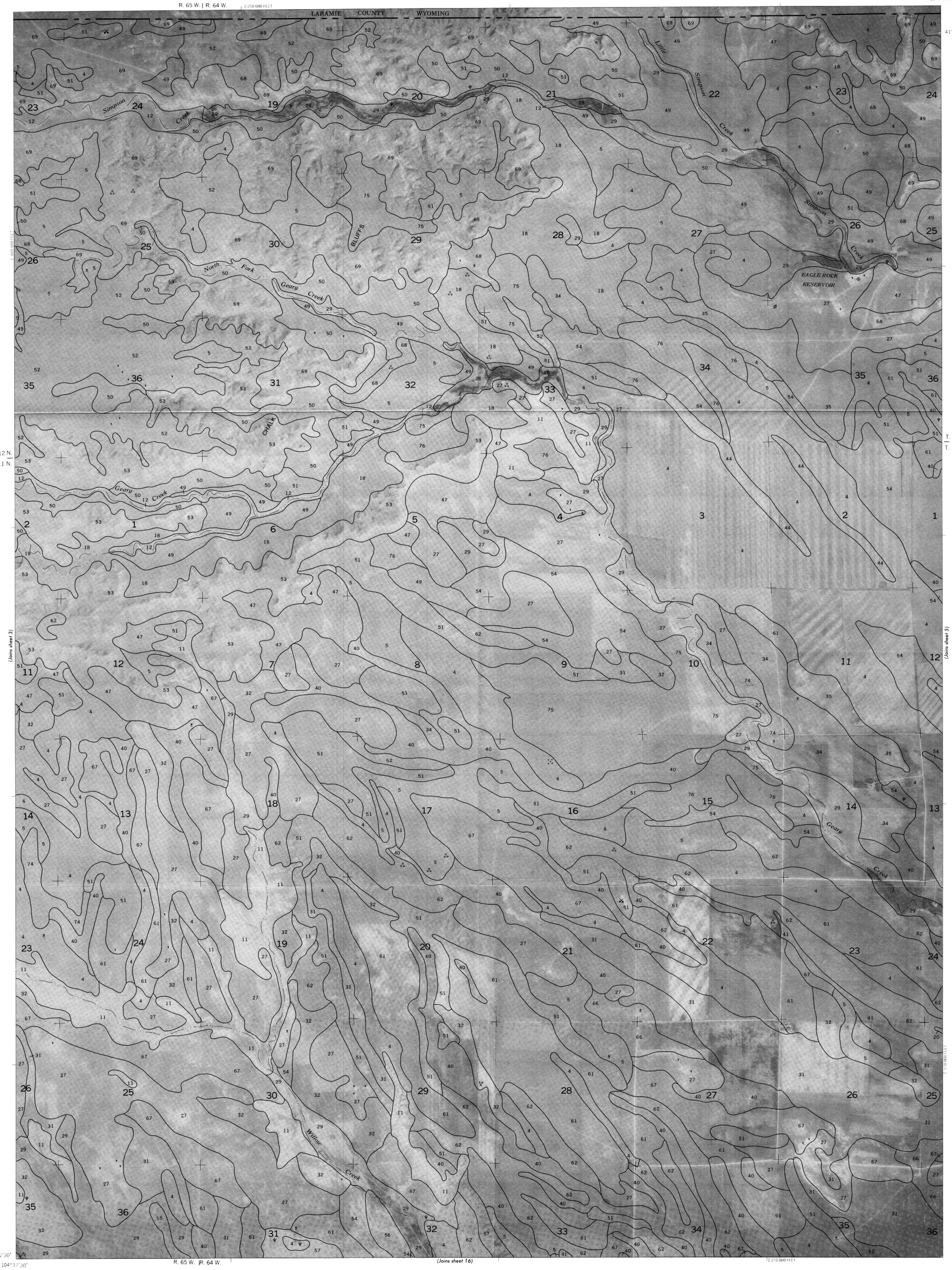
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

WELD COUNTY, COLORADO, NORTHERN PART NO. 3

SOIL SURVEY OF WELD COUNTY, COLORADO, NORTHERN PART

(CHALK BLUFFS EAST QUADRANGLE)



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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

WELD COUNTY, COLORADO, NORTHERN PART NO. 4

R. 64 W. R. 63 W.
2 280 000 FEET
104°22'30"
41°00'00"
LARAMIE COUNTY WYOMING
T. 12 N.
T. 11 N.
570 000 FEET
(Joins sheet 4)
(Joins sheet 6)
(Joins sheet 17)
2 310 000 FEET
40°52'30"
104°30'00"
R. 64 W. R. 63 W.

Bull Creek
Porter Creek
Simpson Creek
Simpson Creek
Porter Creek
Geary Creek
water

SCALE 1:24000
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS

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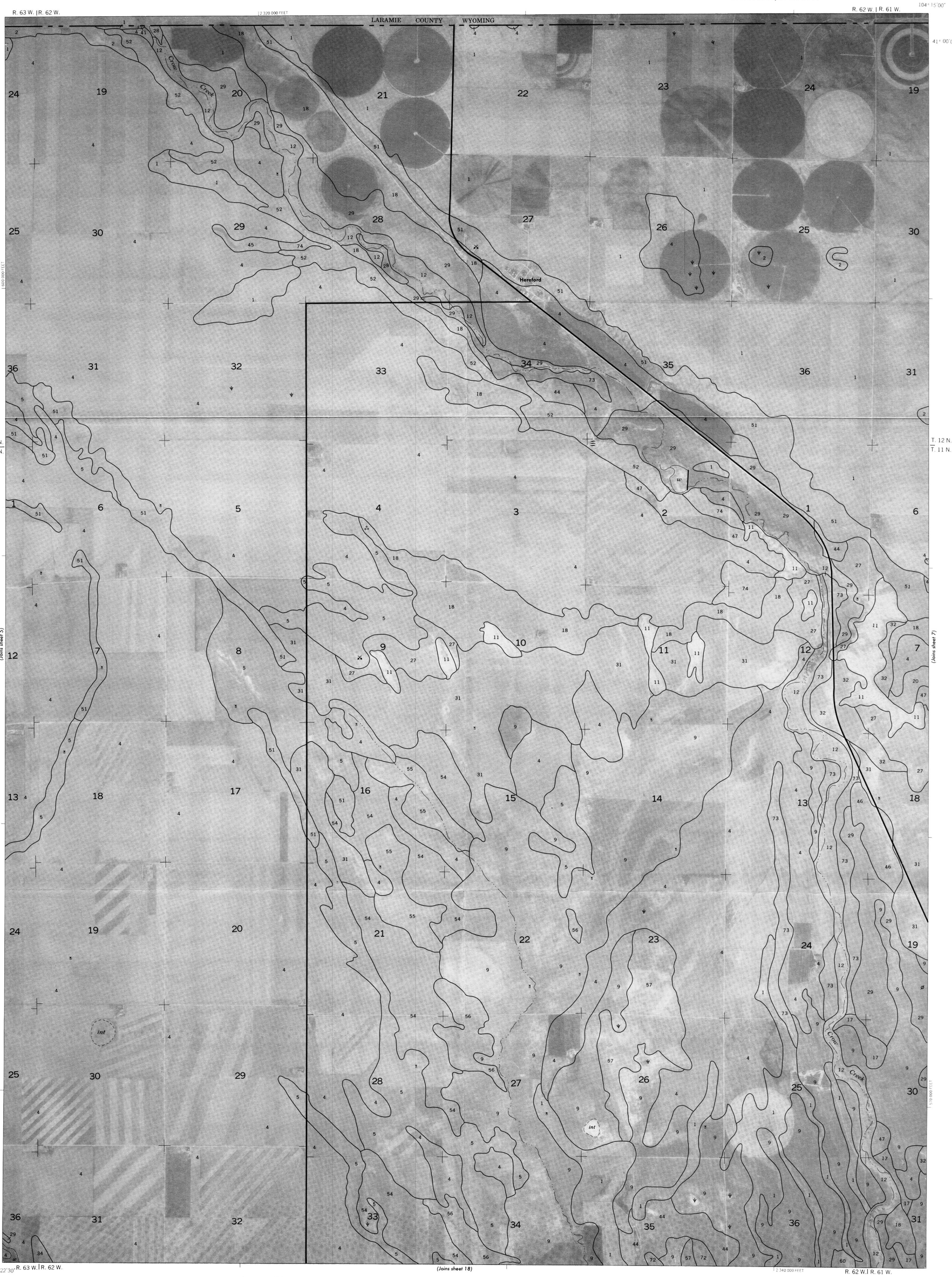
WELD COUNTY, COLORADO, NORTHERN PART NO. 5

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 6

SOIL SURVEY OF WELD COUNTY, COLORADO, NORTHERN PART
(HEREFORD QUADRANGLE)



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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

WELD COUNTY, COLORADO, NORTHERN PART NO. 6

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 7

SOIL SURVEY OF WELD COUNTY, COLORADO, NORTHERN PART

(GROVER NORTH QUADRANGLE)

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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

WELD COUNTY, COLORADO, NORTHERN PART NO. 7

(GROVER NE QUADRANGLE)

R. 60 W. | R. 59 W.

104° 00' 00"
41° 00' 00"

LARAMIE COUNTY WYOMING — KIMBALL COUNTY NEBRASKA

T. 12 N.
T. 11 N.

(Joins sheet 7)

(Joins sheet 9)

(Joins sheet 20)

Draw

Sidney

104° 07' 30"
40° 52' 30"

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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS

SCALE 1:24000

WELD COUNTY, COLORADO, NORTHERN PART NO. 8

2 420 000 FEET
R. 59 W. | R. 58 W.
103°52'30"
610 000 FEET
41°00'00"
KIMBALL COUNTY NEBRASKA
T. 12 N.
T. 11 N.
SUNNYSIDE CEMETERY
Draw
Sidney
(Joins sheet 8)
(Joins sheet 10)
(Joins sheet 21)
570 000 FEET
40°52'30"
104°00'00"
2 440 000 FEET

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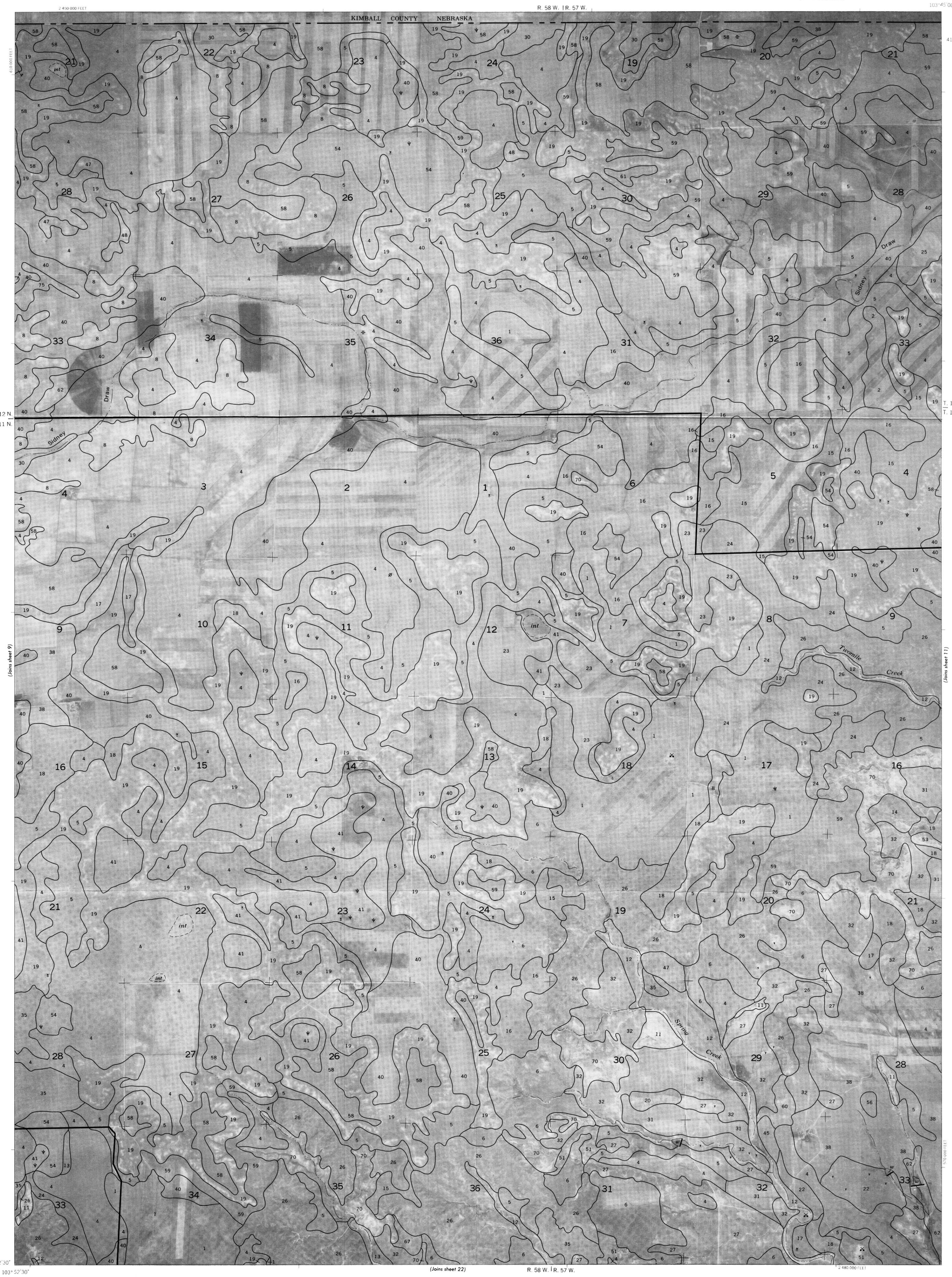
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

WELD COUNTY, COLORADO, NORTHERN PART NO. 9



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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

WELD COUNTY, COLORADO, NORTHERN PART NO. 10

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 11

SOIL SURVEY OF WELD COUNTY, COLORADO, NORTHERN PART

(NEW RAYMER 1NW QUADRANGLE)

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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 2 KILOMETERS
(Joins sheet 23)
SCALE 1:24000

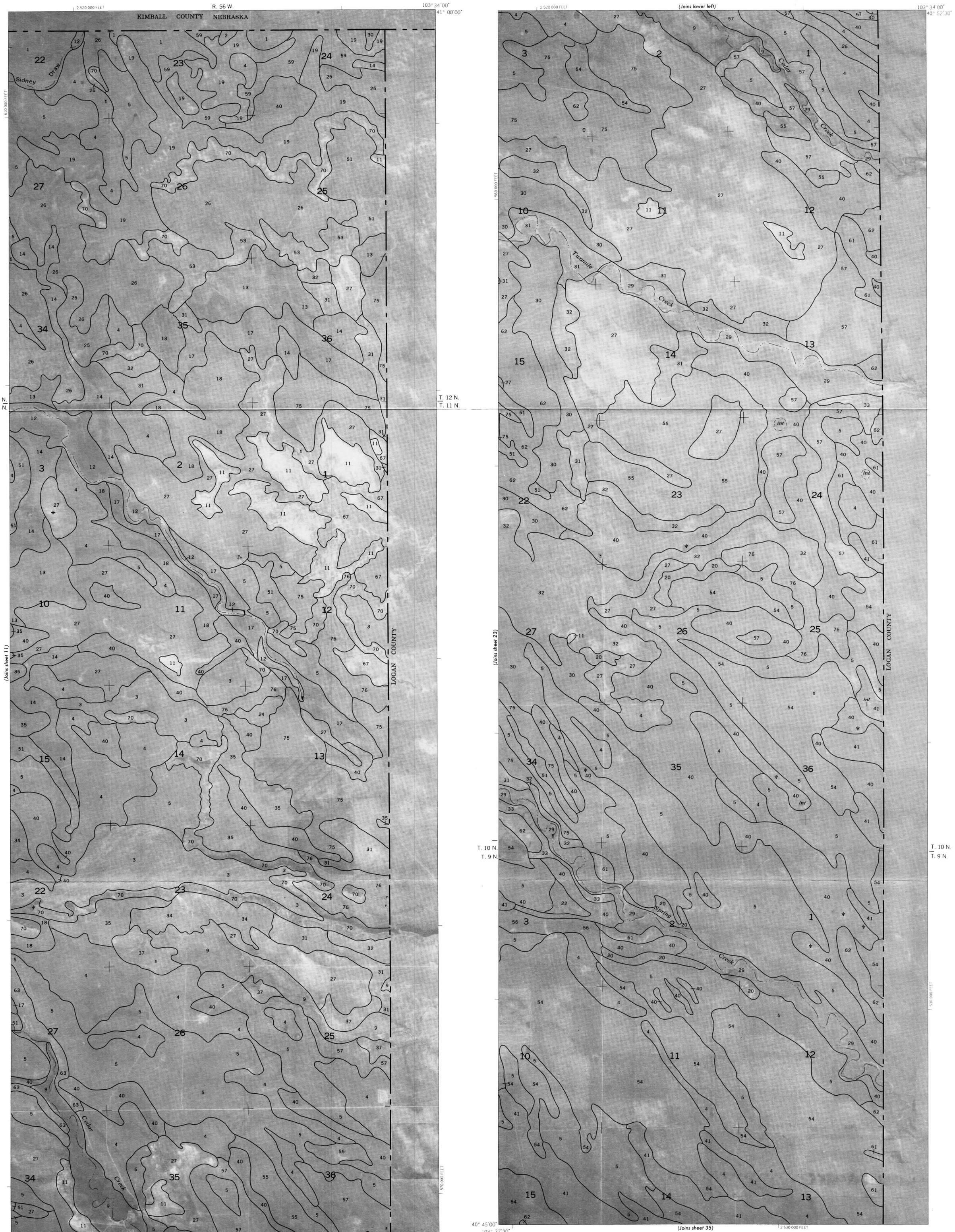
WELD COUNTY, COLORADO, NORTHERN PART NO. 11

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 12

SOIL SURVEY OF WELD COUNTY, COLORADO, NORTHERN PART

(NEW RAYMER 1SW QUADRANGLE)



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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

WELD COUNTY, COLORADO, NORTHERN PART NO. 12

2 140 000 FEET
560 000 FEET
(Joins sheet 1)
R. 67 W.
104°52'30"
40°52'30"
T. 11 N.
T. 10 N.
Spring Creek
DECKER PIERCE RESERVOIR
Spring Creek
Coalbank Creek
LARIMER COUNTY
T. 10 N.
T. 9 N.
40°45'00"
105°00'00"
(Joins sheet 24)
R. 67 W.
2 170 000 FEET
520 000 FEET
(Joins sheet 14)

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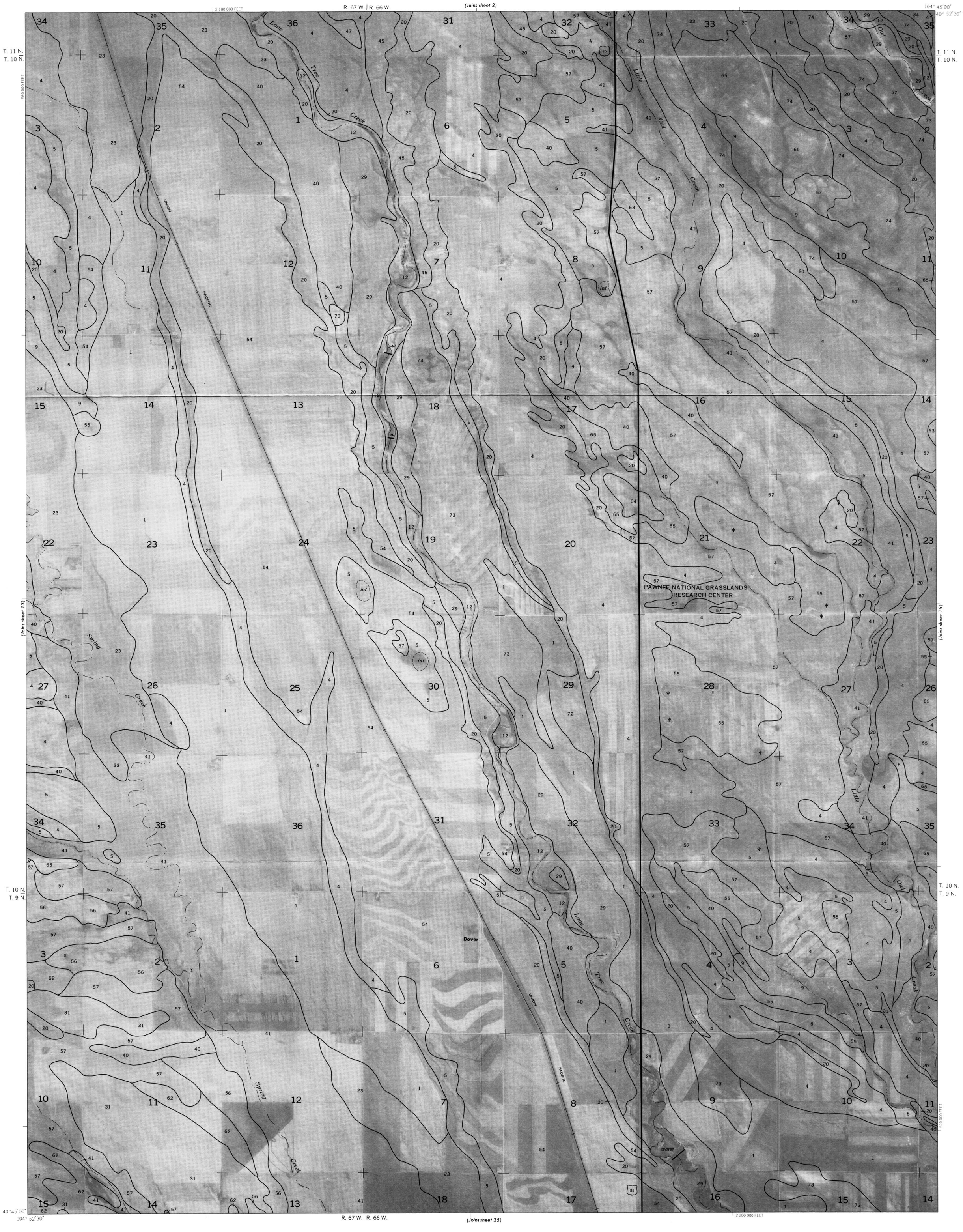
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000



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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

R. 65 W. | R. 64 W. | 2 250 000 FEET (Joins sheet 4) 104° 30'00" 40° 52'30"

T. 11 N. T. 10 N. | 660 000 FEET

West Fork

Willow Creek

int

Willow Creek

Cool Creek

Coal Creek

Wild Horse Creek

(Joins sheet 15) (Joins sheet 17)

T. 10 N. T. 9 N.

40° 45'00" 104° 37'30"

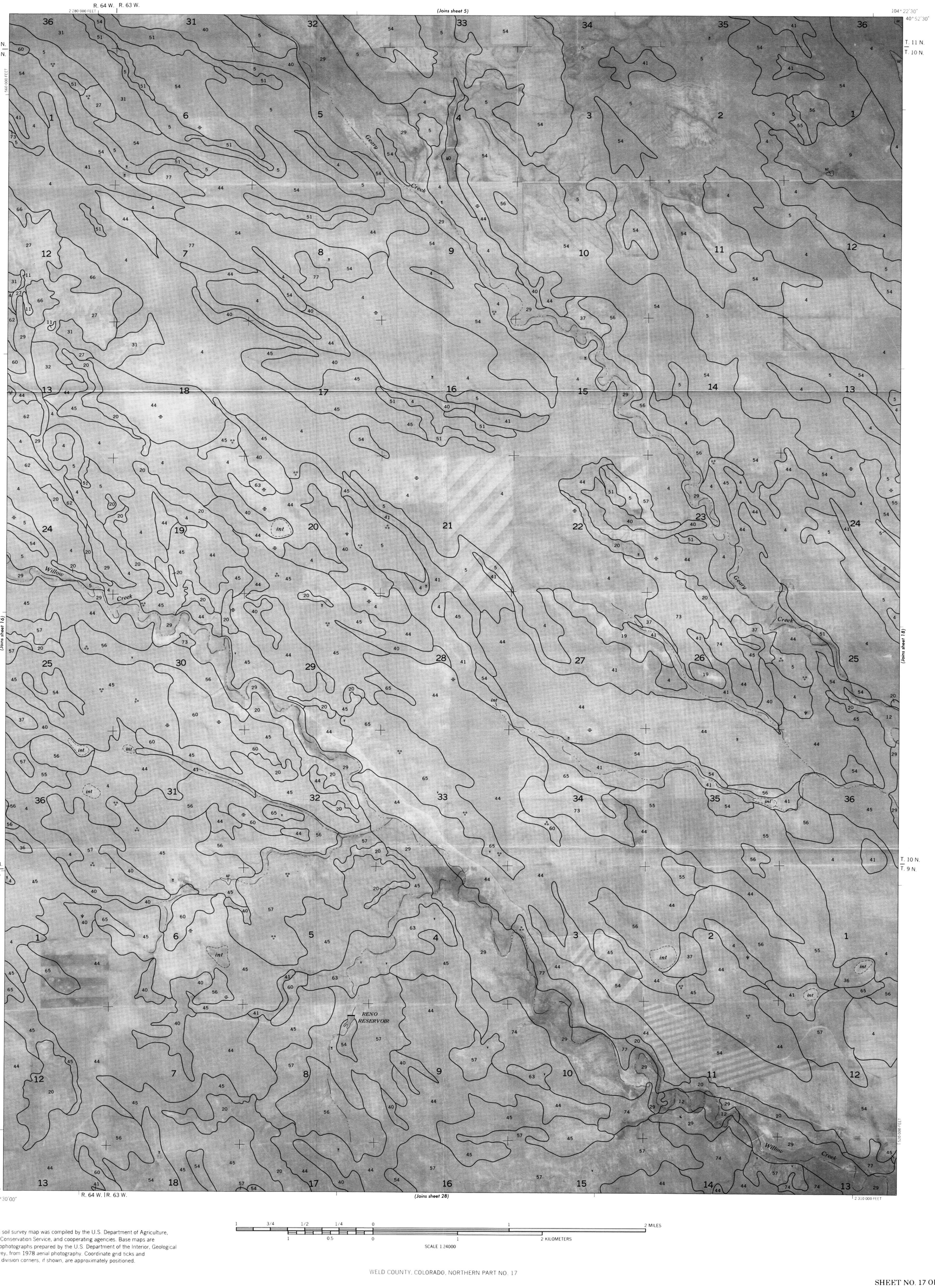
R. 65 W. | R. 64 W. (Joins sheet 27) | 2 270 000 FEET

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

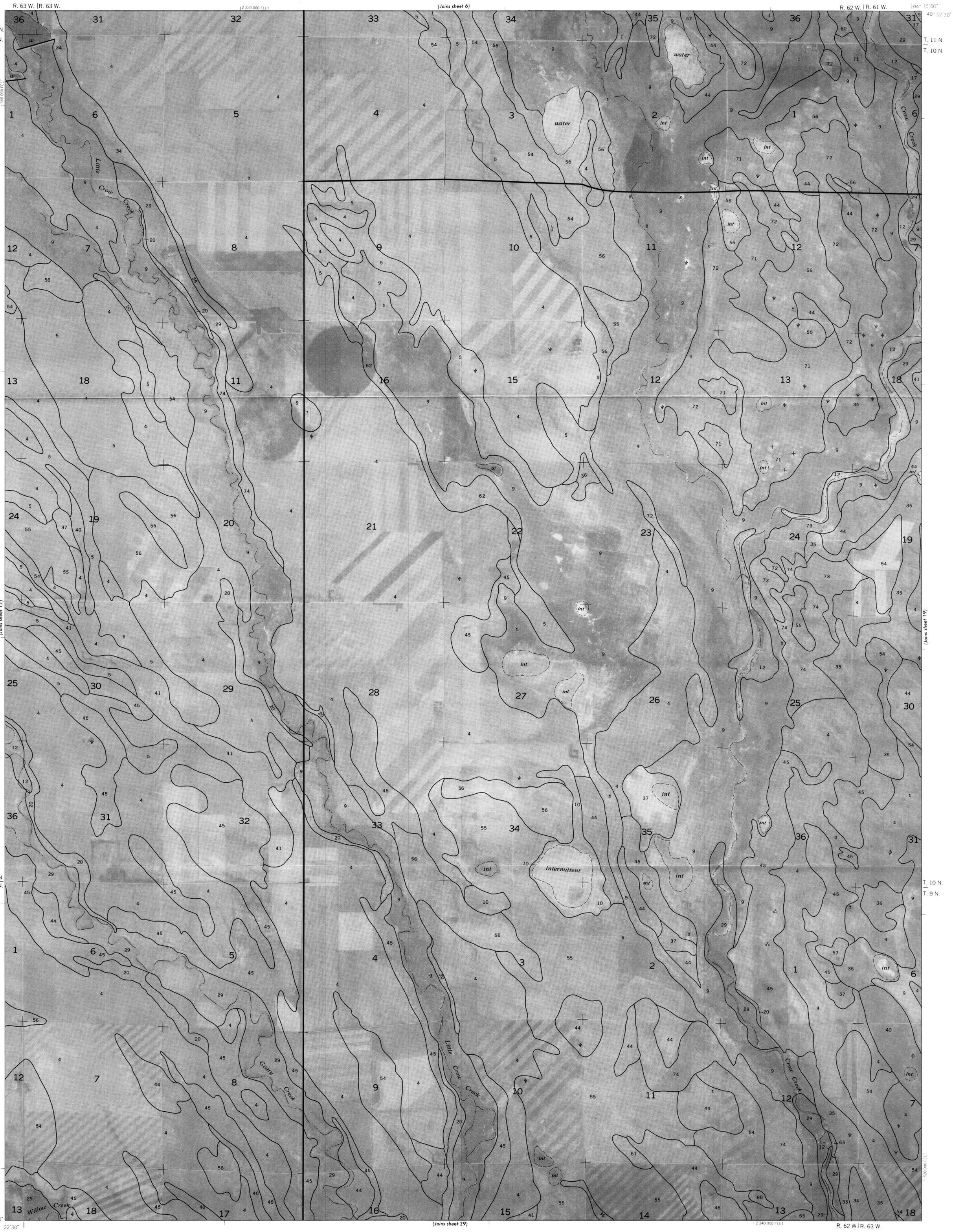
SOIL SURVEY OF WELD COUNTY, COLORADO, NORTHERN PART

(RENO RESERVOIR QUADRANGLE)



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000



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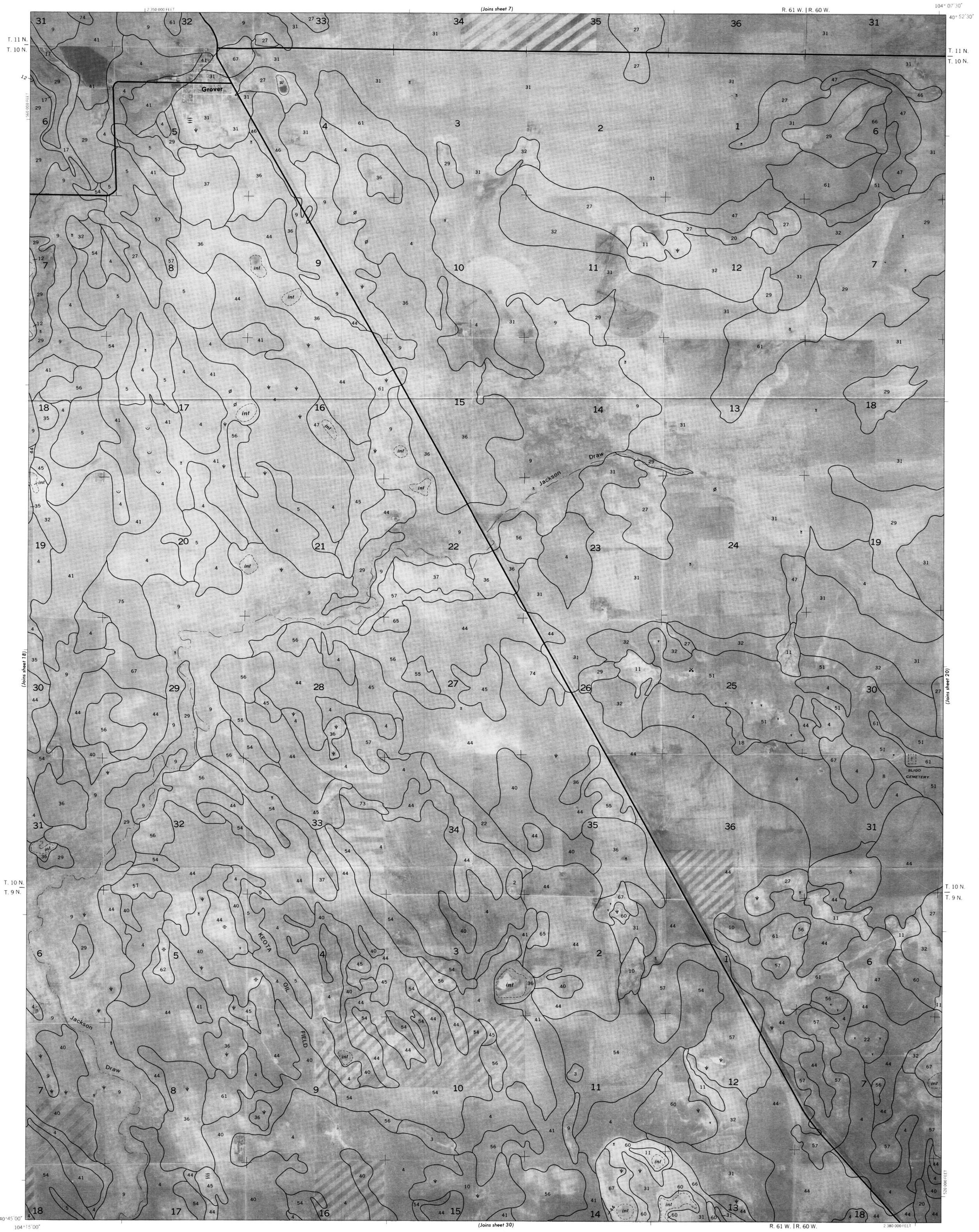
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 19

SOIL SURVEY OF WELD COUNTY, COLORADO, NORTHERN PART

(GROVER SOUTH QUADRANGLE)



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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

WELD COUNTY, COLORADO, NORTHERN PART NO. 19

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 20

SOIL SURVEY OF WELD COUNTY, COLORADO, NORTHERN PART

(GROVER SE QUADRANGLE)

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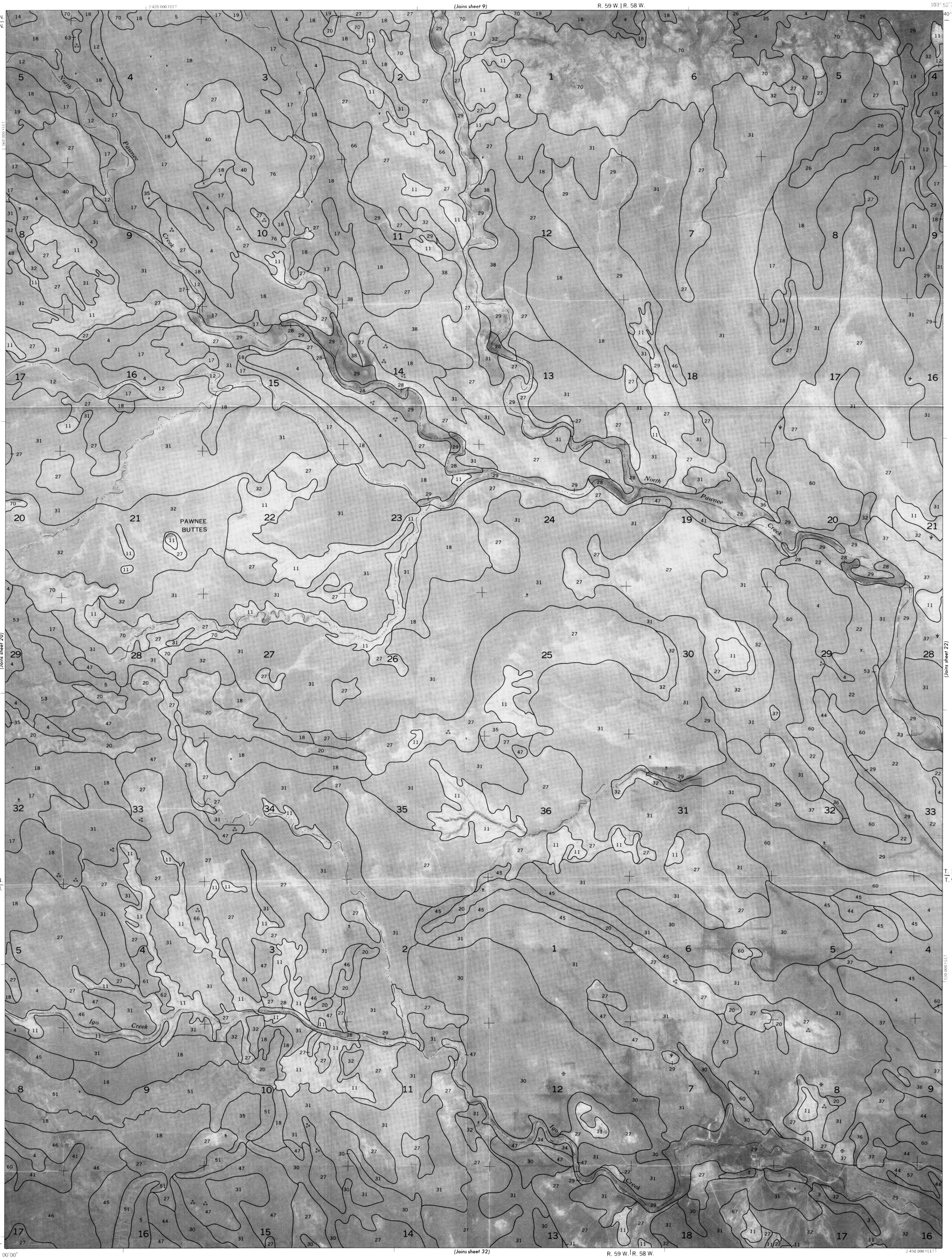
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 21

SOIL SURVEY OF WELD COUNTY, COLORADO, NORTHERN PART

(NEW RAYMER 2SW QUADRANGLE)



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

2 450 000 FEET

(Joins sheet 10)

R. 58 W. | R. 57 W.

103° 45'00"

40° 52'30"

560 000 FEET

Spring Creek

Horsetail Creek

North Pawnee Creek

Cottonwood Creek

Igo Creek

(Joins sheet 21)

(Joins sheet 23)

T. 10 N.
T. 9 N.

530 000 FEET

40° 45'00"

103° 52'30"

(Joins sheet 33)

R. 58 W. | R. 57 W.

2 480 000 FEET

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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

(Joins sheet 11)

R. 57 W. | R. 56 W.

2 490 000 FEET

103° 37' 30"

40° 52' 30"

27

560 000 FEET

TOEDTH RESERVOIR

Spring Creek

Twomile Creek

LIBERTY COMMUNITY CENTER

Horsetail Creek

Spring Creek

Horsetail Creek

Cottonwood Creek

11

(Joins sheet 22)

(Joins inset, sheet 12)

T. 10 N.
T. 9 N.

40° 45' 00"

103° 45' 00"

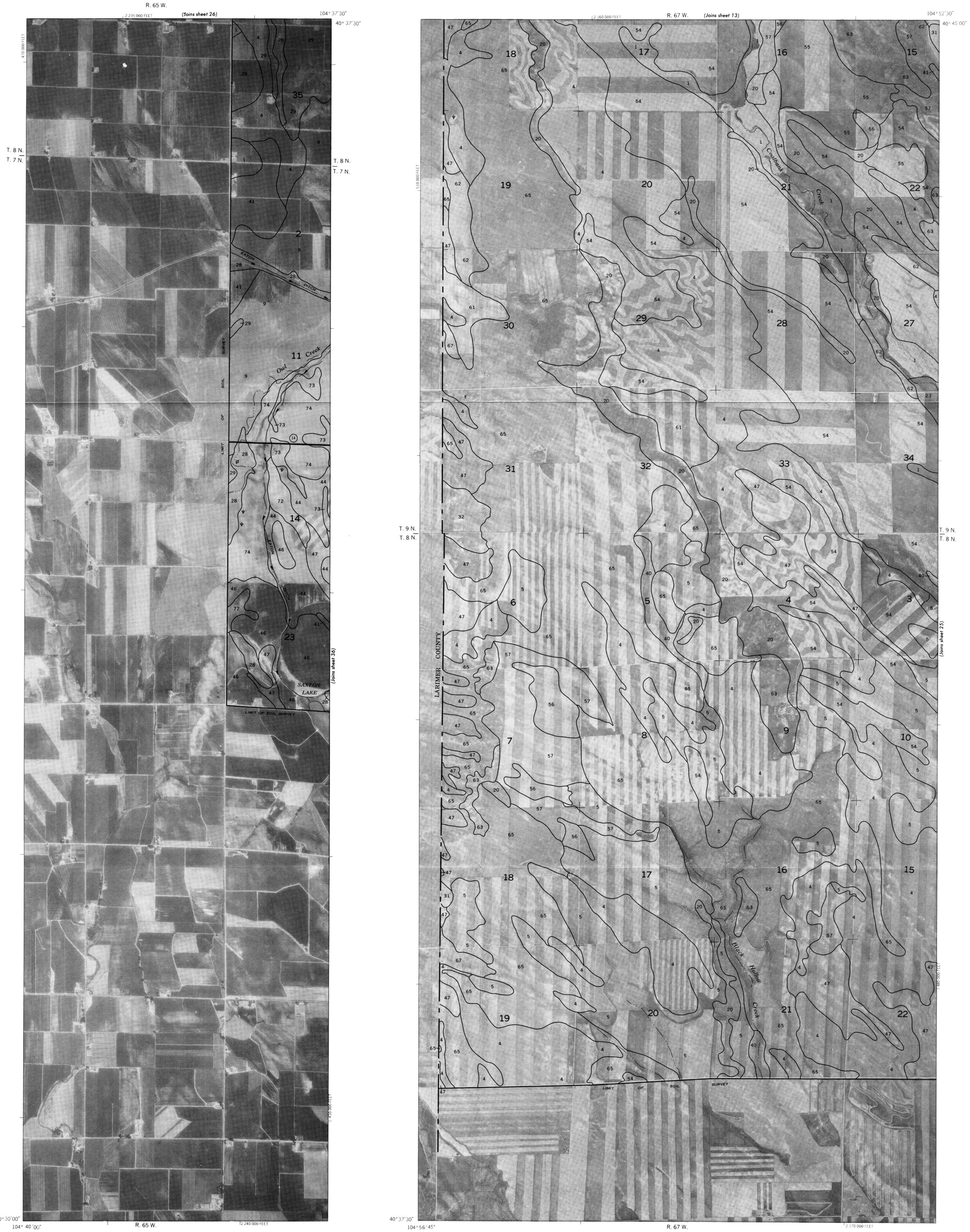
2 510 000 FEET

R. 57 W. | R. 56 W.

(Joins sheet 34)

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000



1000 0 AND 5000-FOOT GRID TICKS

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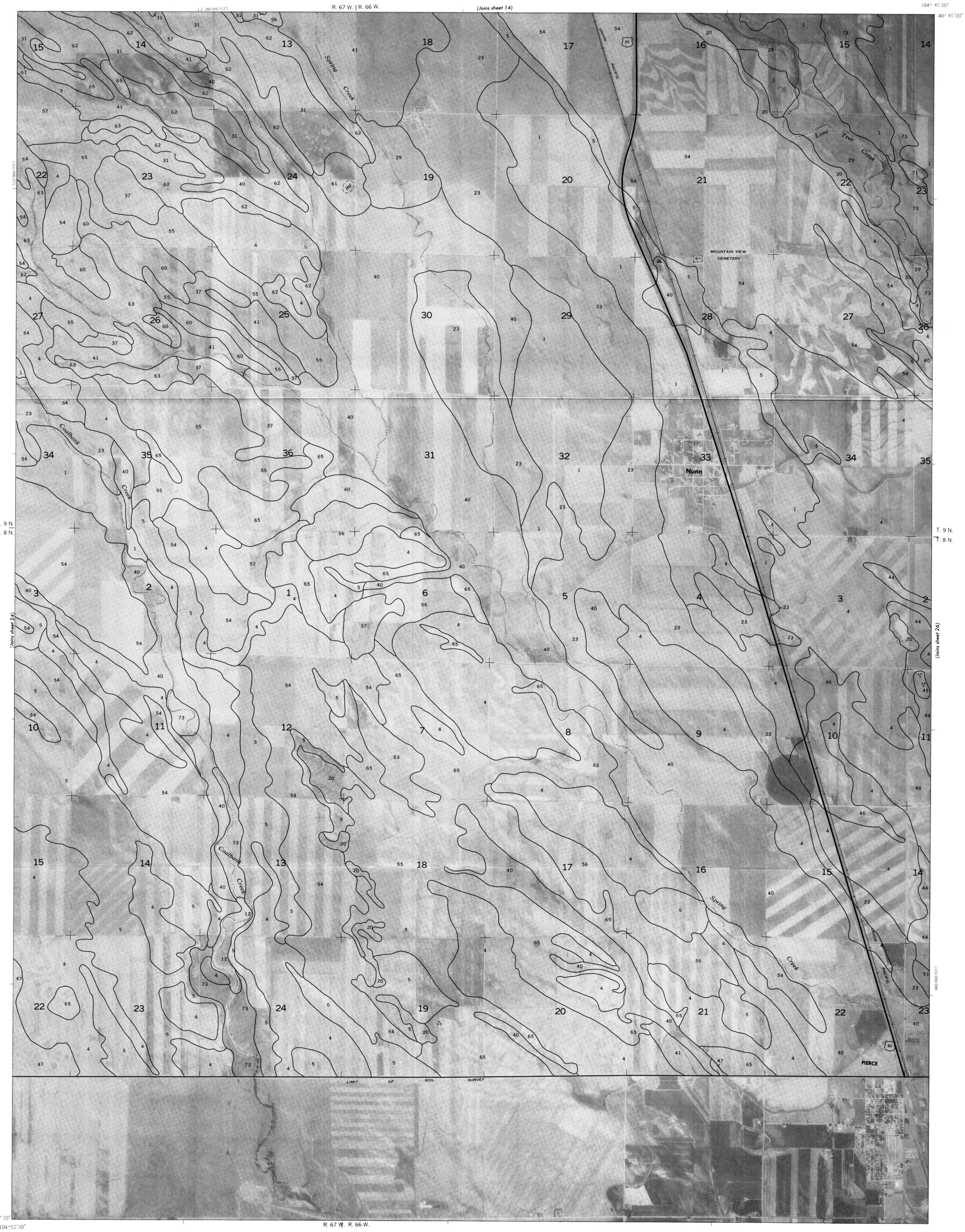
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

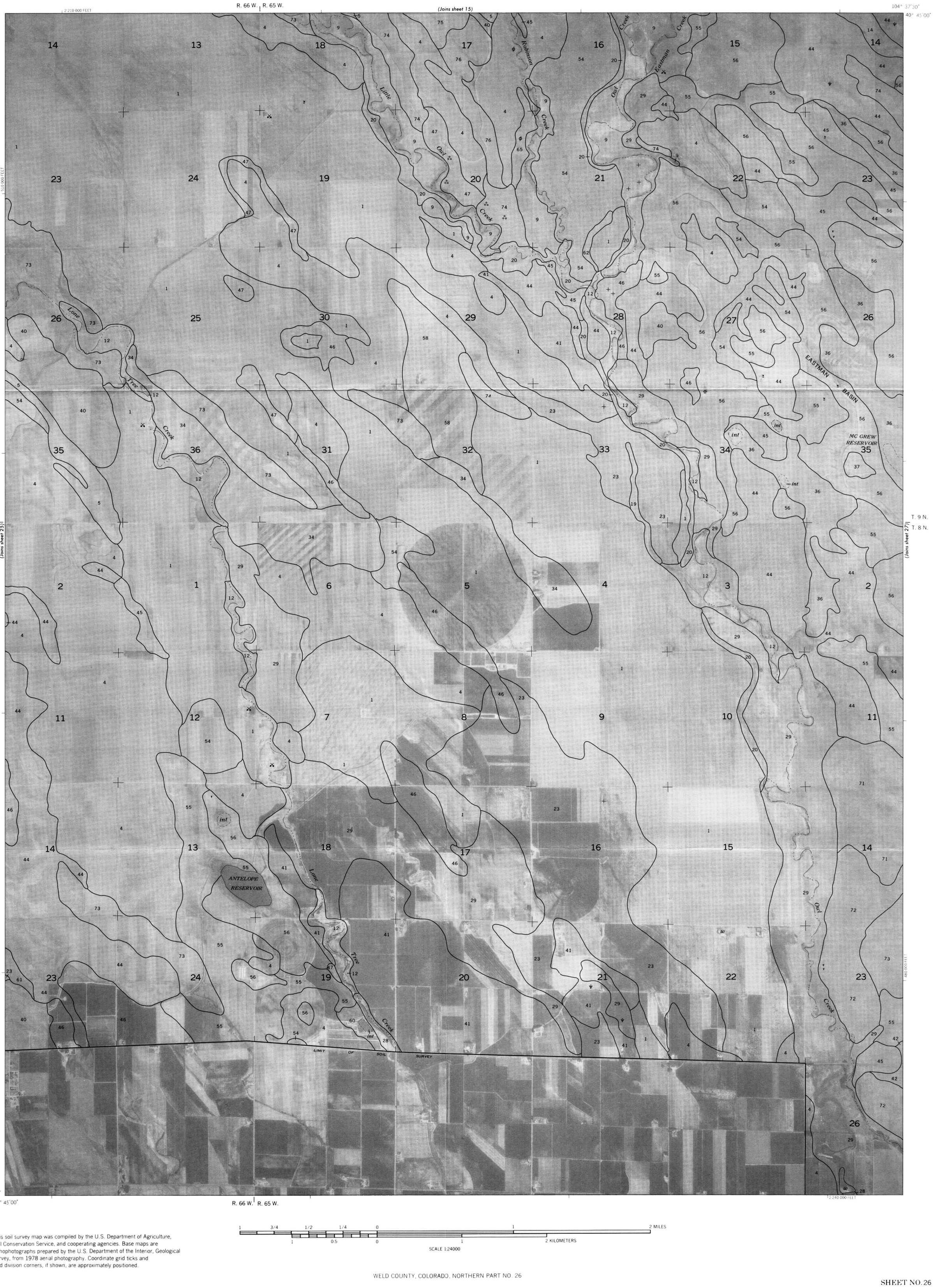
SOIL SURVEY OF WELD COUNTY, COLORADO, NORTHERN PART

(NUNN QUADRANGLE)



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

R. 65 W. | R. 64 W.
2 250 000 FEET
(Joins sheet 16)
104° 30' 00"
40° 45' 00"
510 000 FEET
T. 9 N.
T. 8 N.
(Joins sheet 28)
EASTMAN BASIN
MC GREW RESERVOIR
THOMAS LAKE RESERVOIR
Coal Creek
Wild Horse Creek
Purcell
2 270 000 FEET
1 460 000 FEET
104° 37' 30"
40° 37' 30"
R. 65 W. | R. 64 W.
(Joins sheet 36)

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

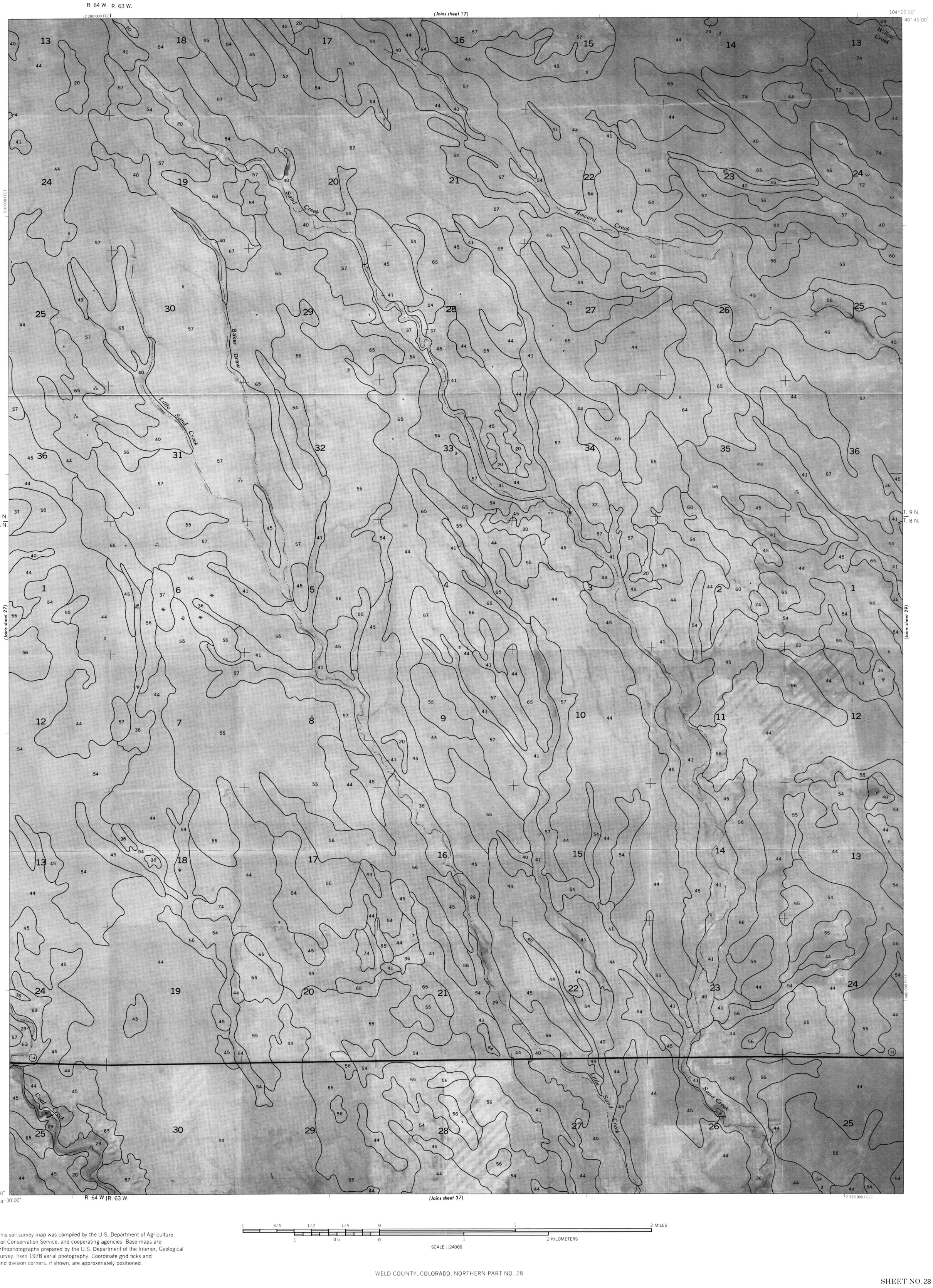
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 28

SOIL SURVEY OF WELD COUNTY, COLORADO, NORTHERN PART

(BAKER DRAW QUADRANGLE)



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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

WELD COUNTY, COLORADO, NORTHERN PART NO. 28

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 29

SOIL SURVEY OF WELD COUNTY, COLORADO, NORTHERN PART

(BRIGGSDALE QUADRANGLE)

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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 30

SOIL SURVEY OF WELD COUNTY, COLORADO, NORTHERN PART

(KEOTA NW QUADRANGLE)

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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 31

SOIL SURVEY OF WELD COUNTY, COLORADO, NORTHERN PART

(KEOTA QUADRANGLE)

2 390 000 FEET | (Joins sheet 20) | R. 60 W. | R. 59 W. | 104°00'00" | 40°45'00"

Wild Horse Creek

Keota

T. 9 N.
T. 8 N.

(Joins sheet 30) | (Joins sheet 32)

5 000 FEET

40°37'30" | 104°07'30" | (Joins sheet 40) | R. 60 W. | R. 59 W. | 2 410 000 FEET | 480 000 FEET

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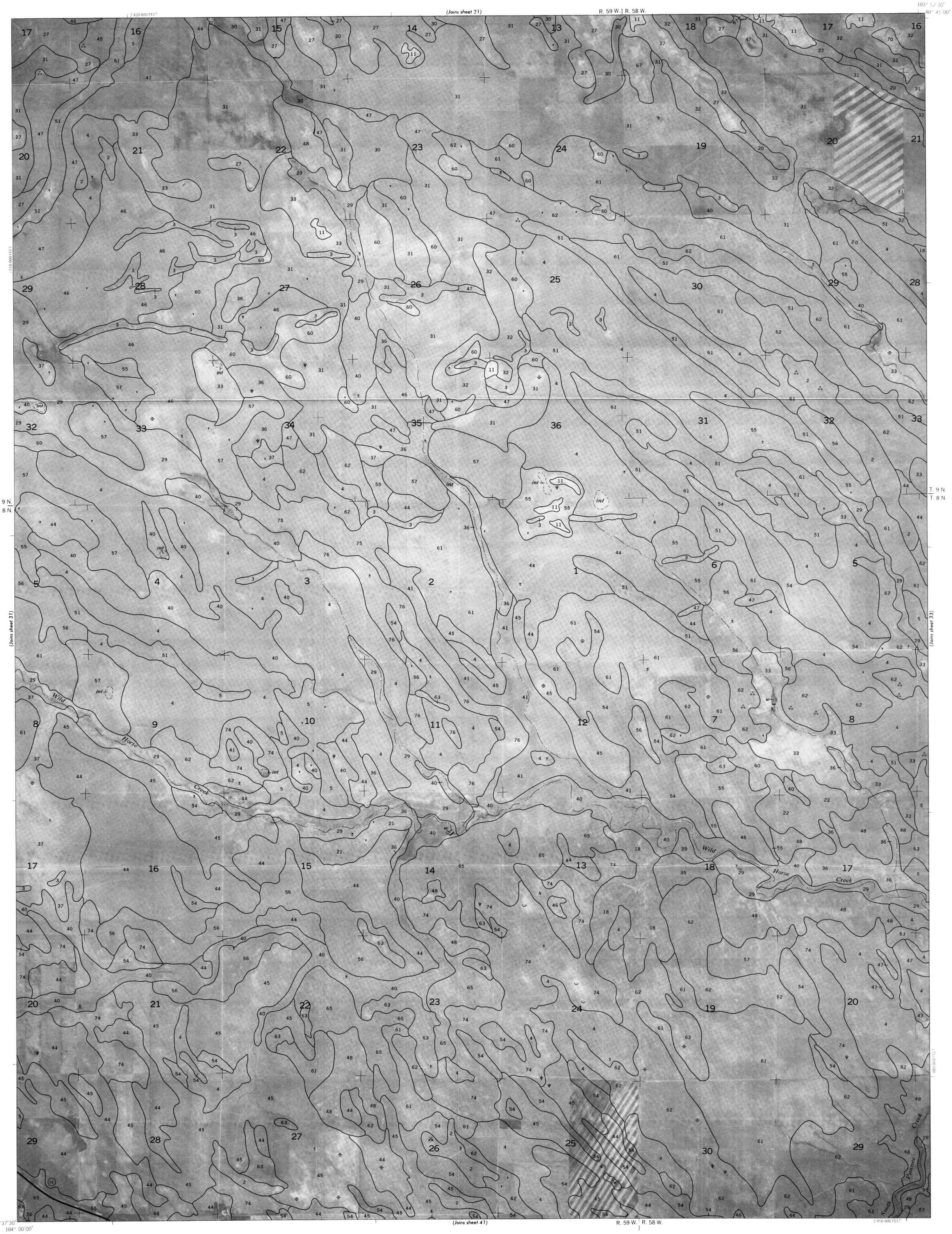
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

R. 58 W. R. 57 W.

103° 45'00"
40° 45'00"

2 460 000 FEET

520 000 FEET

(Joins sheet 22)

T. 9 N.
T. 8 N.

(Joins sheet 32)

(Joins sheet 34)

Igo Creek

North Pawnee Creek

South Pawnee Creek

RAYMER CEMETERY

40° 37'30"
103° 52'30"

(Joins sheet 42)

2 480 000 FEET

1 480 000 FEET

1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

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2 490 000 FEET
520 000 FEET
R. 57 W. | R. 56 W. *(Joins sheet 23)*
103° 37'30"
40° 45'00"
T. 9 N.
T. 8 N.
(Joins sheet 33)
(Joins sheet 35)
40° 37'30"
103° 45'00"
R. 57 W. | R. 56 W. *(Joins sheet 43)*
2 520 000 FEET
4 481 000 FEET

Cottonwood Creek
Horsetail Creek
North Pawnee Creek
Pawnee Creek
South Pawnee Creek
int

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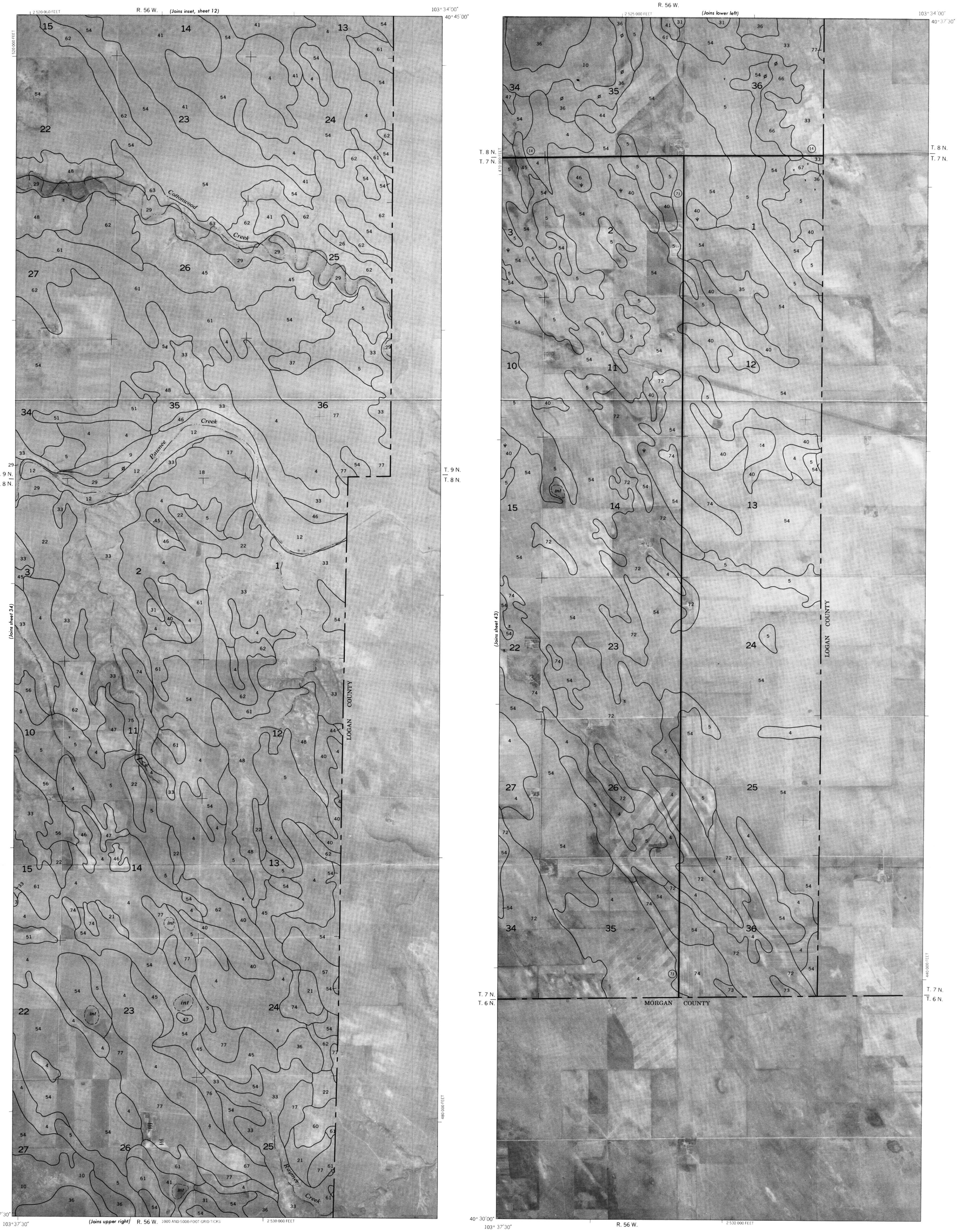
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 35

SOIL SURVEY OF WELD COUNTY, COLORADO, NORTHERN PART

(NEW RAYMER 4NE QUADRANGLE)



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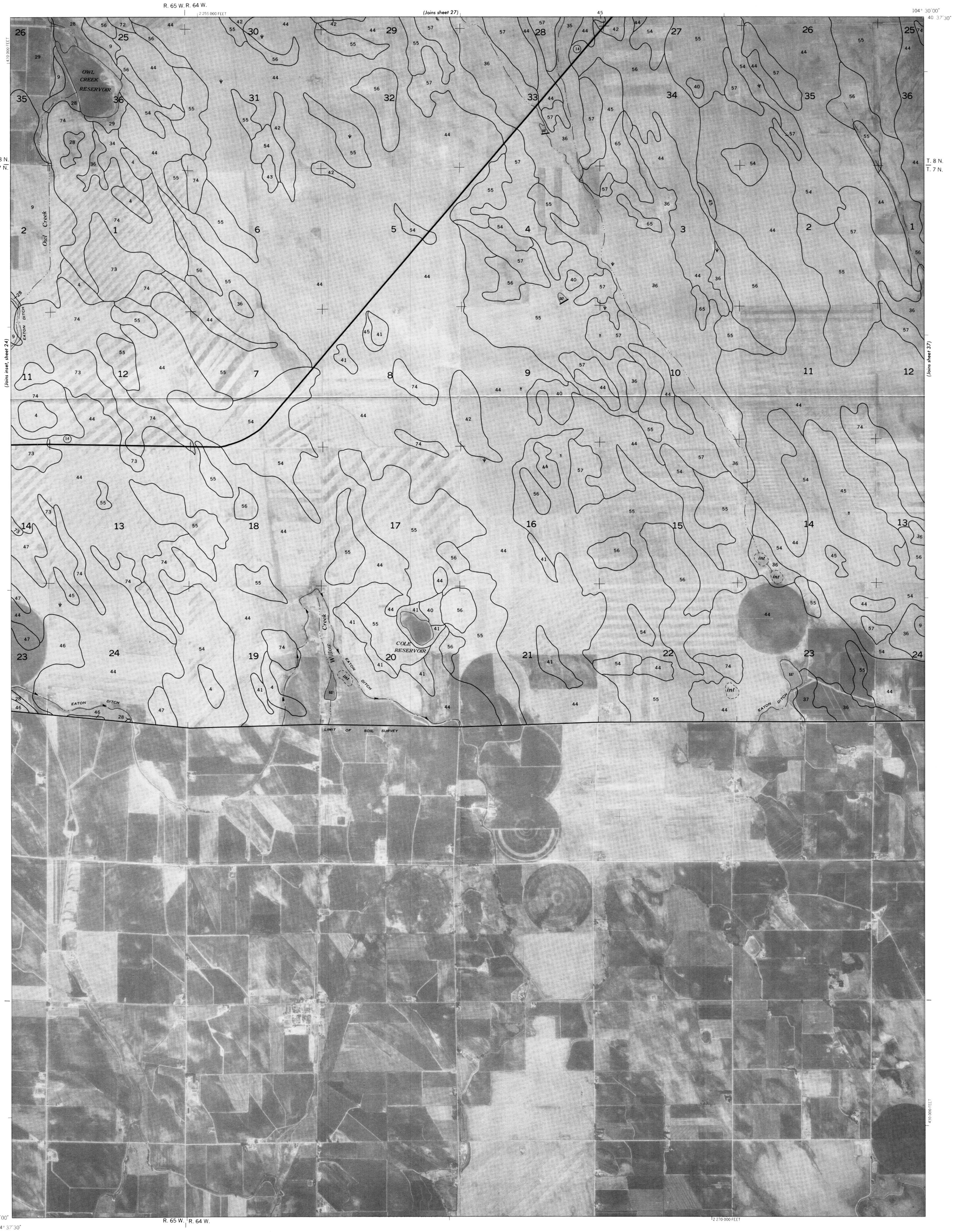
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

1000 AND 5000 FOOT GRID TICKS



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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

R. 64 W. | R. 63 W.

2 280 000 FEET

(Joins sheet 28)

104° 22'30"

40° 37'30"

470 000 FEET

T. 8 N.
T. 7 N.

T. 8 N.
T. 7 N.

(Joins sheet 36)

(Joins sheet 38)

T. 7 N.
T. 6 N.

T. 7 N.
T. 6 N.

430 000 FEET

40° 30'00"

104° 30'00"

R. 64 W. | R. 63 W.

2 310 000 FEET

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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 38

SOIL SURVEY OF WELD COUNTY, COLORADO, NORTHERN PART

(FOSSTON QUADRANGLE)

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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

WELD COUNTY, COLORADO, NORTHERN PART NO. 38

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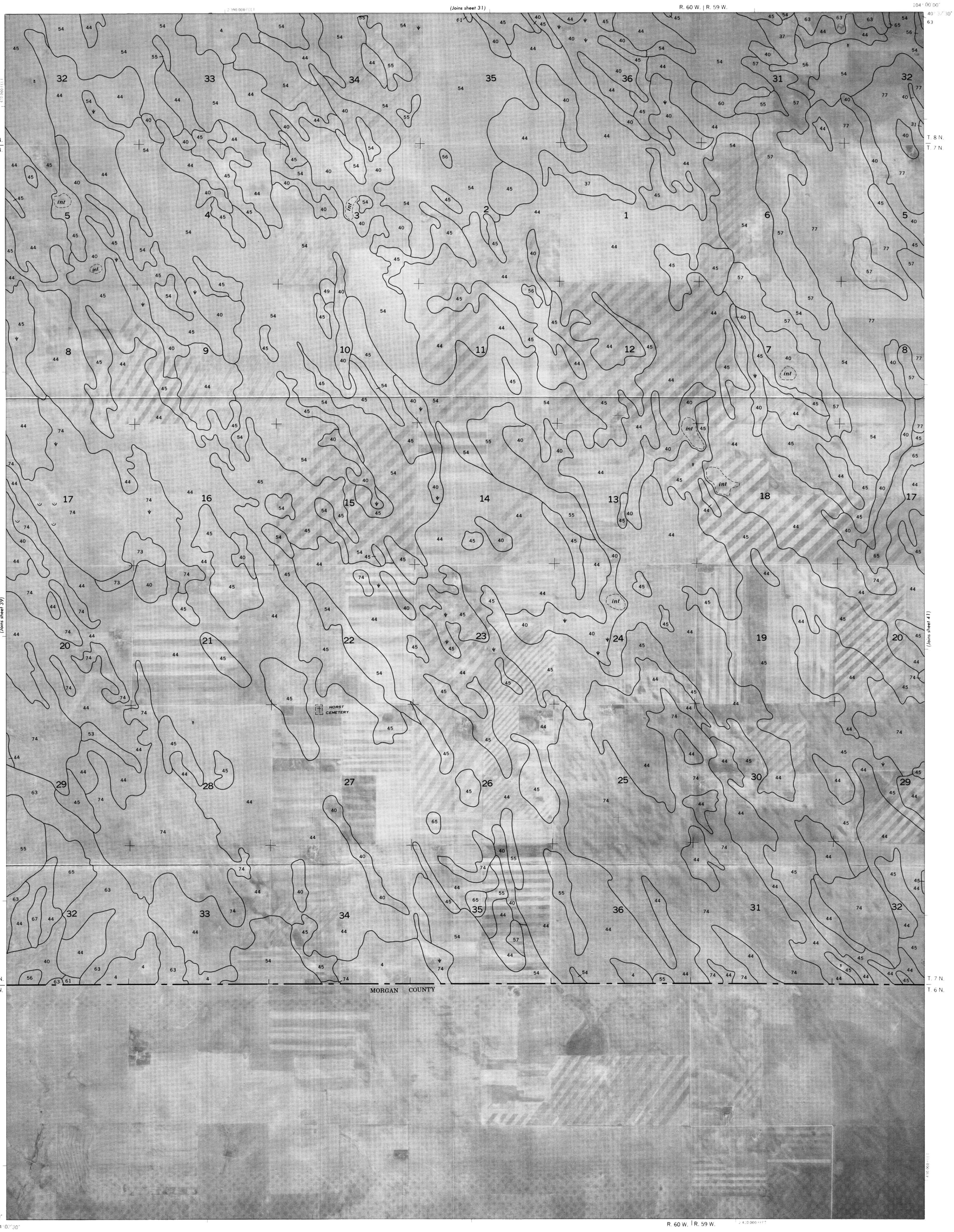
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

WELD COUNTY, COLORADO, NORTHERN PART NO. 39



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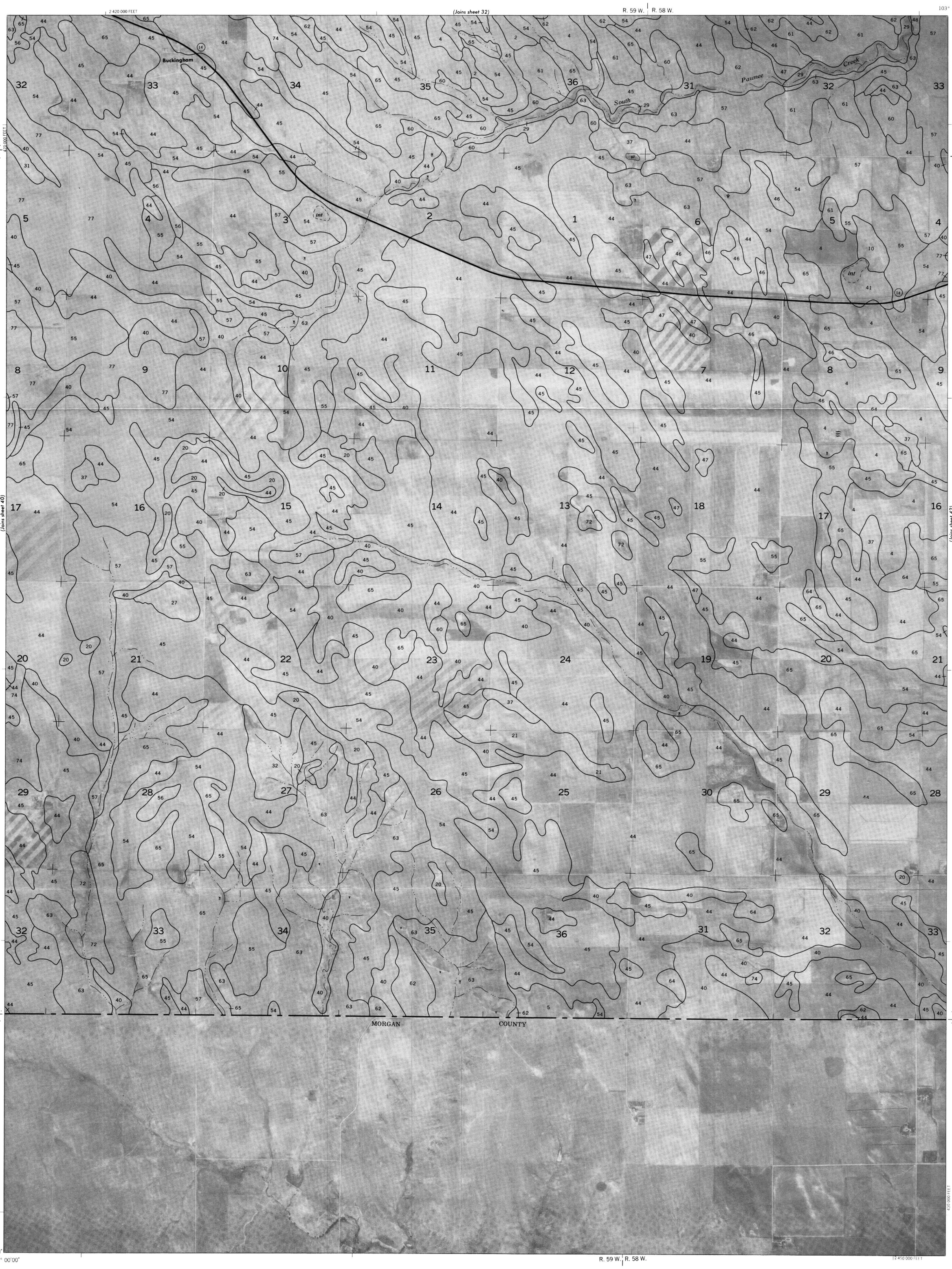
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 41

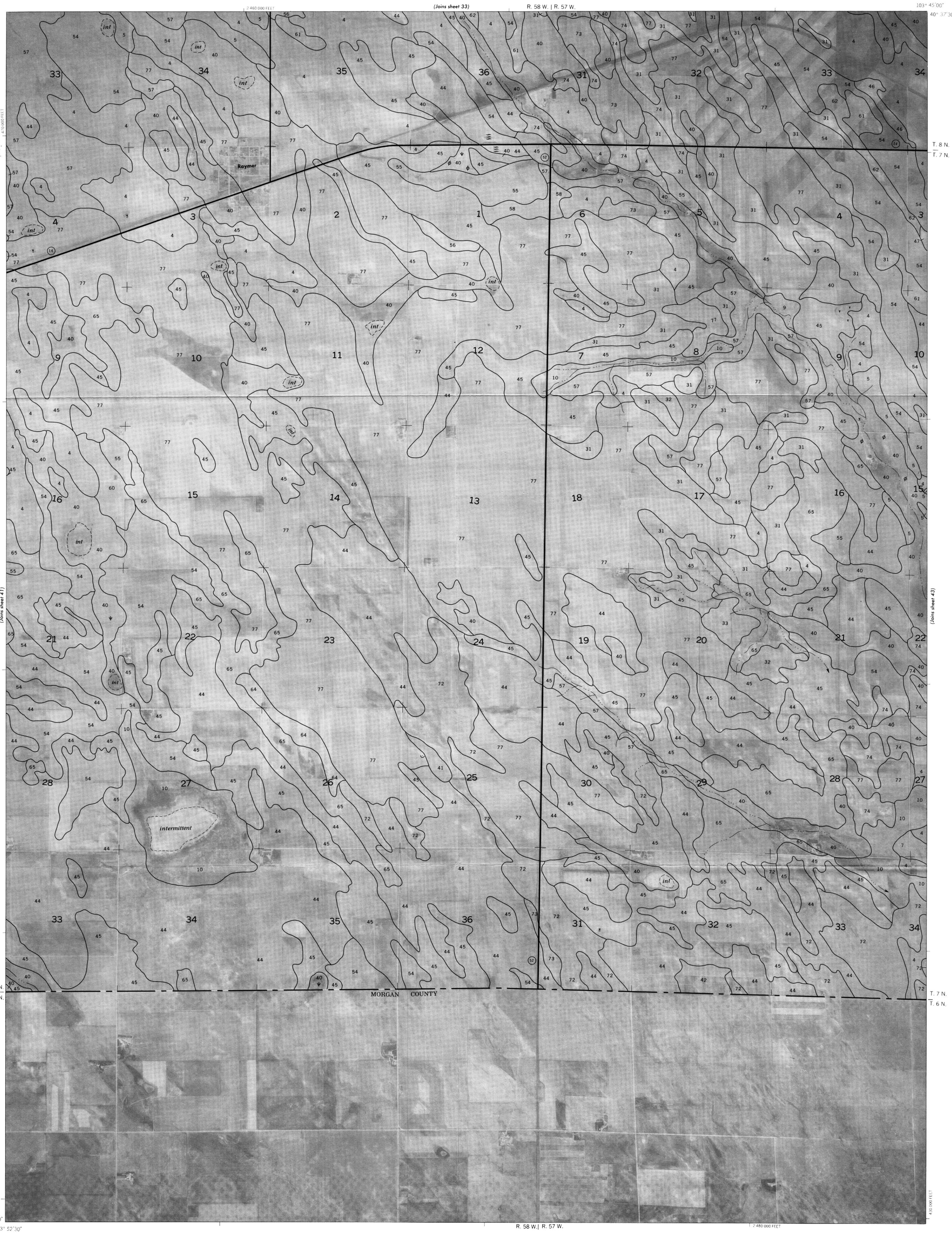
SOIL SURVEY OF WELD COUNTY, COLORADO, NORTHERN PART
(NEW RAYMER 3SW QUADRANGLE)



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

WELD COUNTY, COLORADO, NORTHERN PART NO. 41

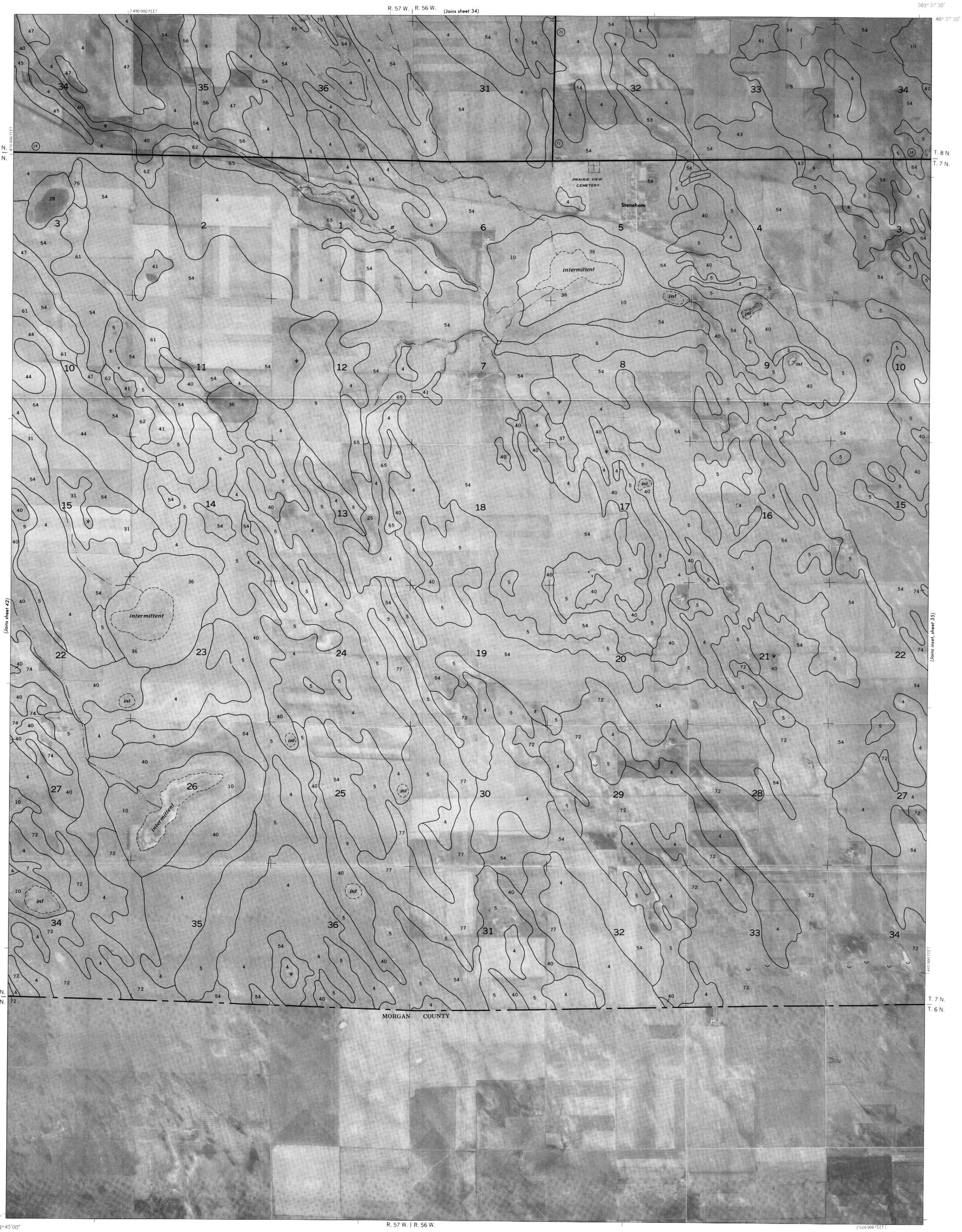


This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1978 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000

SOIL SURVEY OF WELD COUNTY, COLORADO, NORTHERN PART

(NEW RAYMER 4SW QUADRANGLE)



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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24000